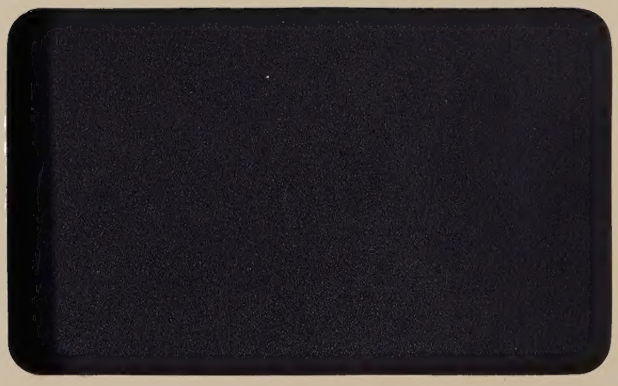
Dolch.

Konsequente Logik Analyse

Operating & Service Manual LAM 4850A



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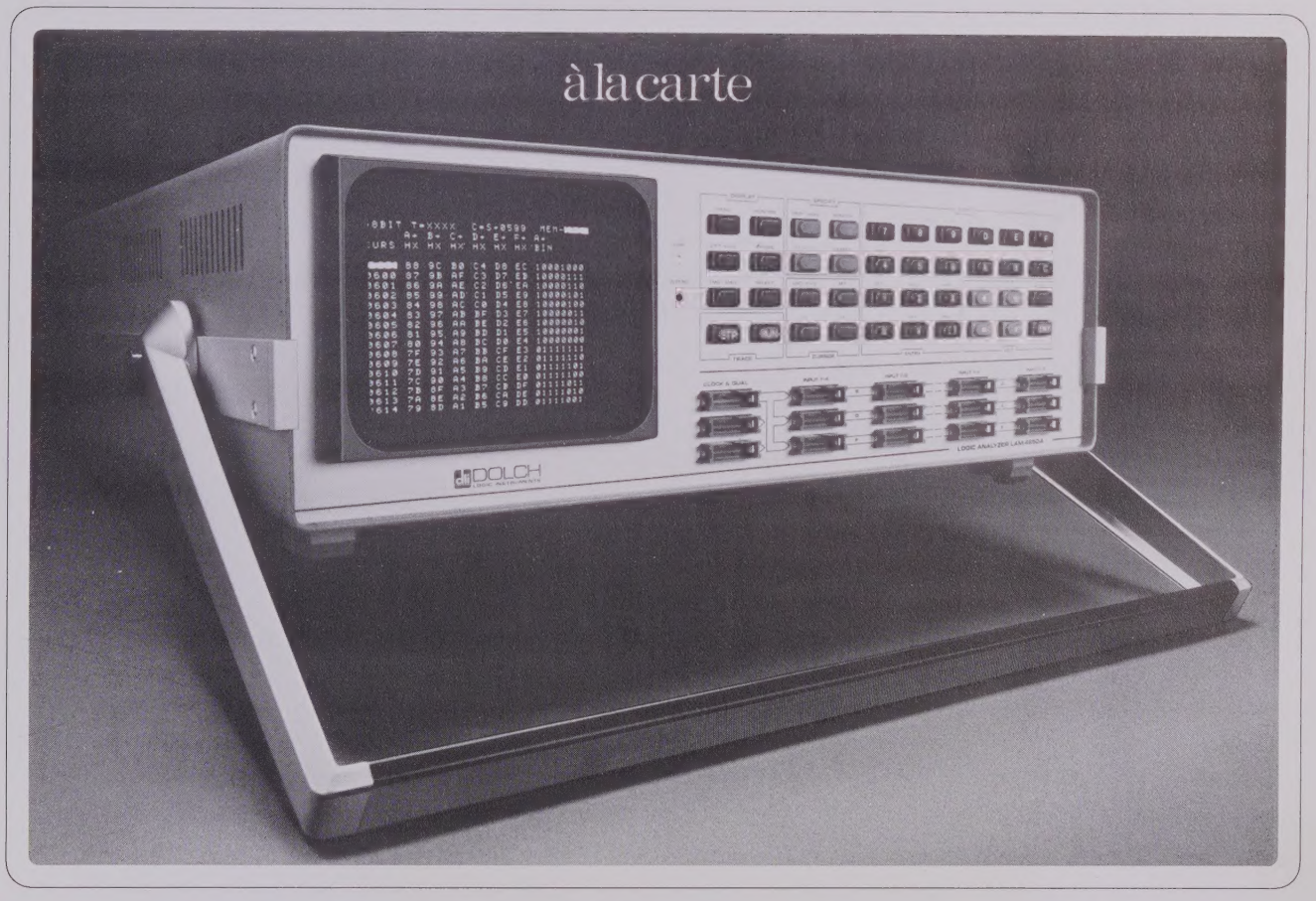
advanced logic analysis



48 to 96 Channels, 300 MHz, plus Mnemonics

DOLCH
LOGIC INSTRUMENTS

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INTRODUCTION

As microprocessor designers pack more performance into less space, the task for logic analysis tools becomes more and more complex.

The evolution of the human interface in combination with intelligent "Probing" along with advanced trigger and analysis features have been predominant areas in the design of Dolch's **LAM 4850 A** Logic Analyzer. The LAM 4850 A is the successor of the world's first 48 channel Logic Analyzer, the LAM 4850, introduced early 1979. On account of the experience gained over many years by supplying highly sophisticated Logic Analyzers to the industry, the LAM 4850 A is one of the most advanced digital tools available today.

To utilize the complex features of the LAM 4850 A, one has to learn how they work and how to apply them effectively. The manual presented here provides a thorough description of all functions, parameters and interactions of the instrument. Due to the complexity of the instrument however, the user should take some time to study, the manual patiently in order to avoid frustration.

Like our products, we are continually refining our manuals and solicit your comments.

Basic Information about the LAM 4850 A

- Specification
- System Architecture

Before data recording

- How to programm the LAM 4850 A

The recording and the LAM 4850 A Monitor

- How to get real data

After recording

- How to use the LAM 4850 A to analyse the data

The Scratch Memory

- How to save the set up for further use

Interfacing

- How to get remote control of the LAM 4850 A

Service Information

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1. BASIC INFORMATION LAM 4850 A

1.1 SPECIFICATIONS

1.1.1 SIGNAL INPUTS

Number..... 60; including 48 data, 3 external clock and 9 clock qualifiers.

Impedance..... 1 MΩ // 10 pF at the probe tip.

Threshold..... Input channel groups A&B; C&D; E&F, Clock & Qual 1,2,3 can be individually set to one of four reference voltages:

- TTL (Preset to + 1.4 volts)
- VI & V2, each programmable from -9.9 volts to +9.9 volts in 0.1 volt increments.
- ECL (Preset to -1.3 volts)

Maximum Voltage.... ±50 volts continuous; ± 250 volts transient

Virtual GND..... Continuous GND potential differences up to ±5 volts between the Logic Analyzer and the systems under test will be compensated. The programmed reference voltage is related to the probe's GND pin. Each probe GND pin can be connected to a different potential.

1.1.2 SAMPLING

Internal Clock..... User programmable from 50 MHz (20ns) to 2 Hz (500 ns) in 1-2-5 steps.

NOTE: 50 MHz only available in 32 bit (2 k) mode for recording block A&B, 48 bit (1 k) mode provides 20 MHz (50 ns) max. rate.

External Clock..... Three independent ext. clock sources can be assigned to three individual recording blocks.

Ext. Clock rate.... DC to 25 MHz

Set Up Time..... Data must be present 15 ns before active clock edge.

Hold Time..... Data must be present 2 ns after active clock edge.

Qualifiers..... Each of the three external clocks can be conditioned by 3 independent qualifiers. The Qualifier gating can be selected true-when-high or true-when-low.

Simultaneous clock. Each of the three 16 channel recording blocks may be independently assigned to an internal or one of three external clock sources.

- Available for all recording blocks: Internal clock, external clock 1, internal OR external clock 1, external clock 1 OR external clock 2.
- Available for block C&D only: External clock 2, internal OR external clock 2.
- Available for block E&F only: External clock 3, internal OR external clock 3.

Latch Mode..... Whenever an even number of threshold transitions occur between two successive clock intervals, an input latch stores the state opposite to that stored at the previous clock interval, thus detecting and recording "Glitches".

Minimum Detectable Glitch: 5 ns with 250 millivolts threshold overdrive.

1.1.3 TRIGGERING

Sequential Trigger Event Levels	Four sequential trigger levels may be specified to complete the sequential trigger process. A "then" or "then not" algorithm may be specified for each trigger event level.
Word Size.....	Each sequential trigger word may be user specified up to 48 bits wide.
Code Selection.....	Each trigger word may be user specified in binary, hexadecimal or octal code, positive or negative logic.
Pass Counters.....	Each sequential trigger event level has an independent user-programmable event counter ranging from 1 to 255 counts.
Restart Trigger....	The fourth trigger event level may be set to perform a "restart" function.
Recording Delay....	After the sequential trigger process, a trigger delay from 0-8192 counts of internal or external clock may be selected before the recording is stopped.

1.1.4 TRIGGER AND TRACE MONITOR

Pretrigger Sampling — This is displayed in real time, if any recording block has found enough pre-trigger data and is ready to accept a trigger condition.

Trigger Tracing.... — As soon as all recording blocks are ready, the occurrence of pre-selected trigger words is displayed in real time while the trigger search is in action.

Recording End..... — This is shown in real time if each individual recording block has finished recording after the occurrence of the sequential trigger events.

Slow Clock..... — When an internal or external clock assigned to a recording block is slower than 10...20 Hz a SLOW CLOCK message is displayed on the screen.

1.1.5 SOURCE AND REFERENCE MEMORIES

Size..... — 48 bits by 1000 words recording (source) and
48 bits by 1000 words reference memory,

Organization ..... — 48 bit MODE:
3 blocks of 16 channels/1000 words each
32 bit MODE:
1 block of 16 channels/2000 words
1 block of 16 channels/1000 words

SCRATCH..... — A scratch register (with 3 months battery backup) provides a means of storing up to 6 different configurations of each basic operating modes for quick access to commonly used setup procedures.

1.1.6 COMPARE FUNCTIONS

Halt if..... Each time a trigger sequence (and delay) is completed, the unit arms itself and acquires new data in source memory which is compared to reference memory. Further recording is stopped if conditions previously specified, (R=S, R=S) are met.

Count if..... Each time a trigger sequence (and Delay) is completed, the unit arms itself and acquires new data in source memory which is compared to reference memory. Each recording action increments a 5 digit cycle counter. An event counter (0 to 65535) is incremented whenever conditions are met which agree with those previously specified (R=S, R=S).

Compare Limits..... Any portion of the source memory may be compared with the corresponding portion of the reference memory.

Compare Skew..... Operates in conjunction with "Compare Limits". Checks if source and reference data matches within a selected skew range. Any skew from ±00 to ±99 can be assigned. The user can select a bit for bit (individual channel) or a byte for byte (8bit word) skew range.

1.1.7 SEARCH FUNCTIONS

(Non)Compare Search — Any word and bit (un)equal in reference and source memory can be located by the cursor. Differences between both memories can be marked by an inverse video display.

Word Search..... — The user can define random words in binary, hex or octal code using the keyboard. The defined word will be located by the cursor.

Word Sequence Search..... — The user can define a string of 12 consecutive words through a separate display page. This word string will be located.

Search Event Counter..... — Beginning at any actual position the the cursor can be placed automatically at the next memory location in the recorded data stream and will be displayed, together with the number of search events which occur between the beginning of the memory and the cursor location.

1.1.8 DISPLAY FORMATS

Menus..... Four basic menus are available: Trace, Trigger, Compare and Option.

Timing Diagram..... All 48 channels can be displayed in timing. Three groups of 16 channels each (A&B, C&D, E&F) are selected at one time. All bits per channel (1K or 2K) are display entirely as they are recorded. Magnification is available x 10 (x 5) and x 20 (x 10).

Cursor..... A continuous line, which can be relocated in the data stream.

Set-Marker..... A second continuous line can be held as a marker. The distance between Set and Cursor is calculated and displayed in time and the area is marked by intensification (white "Curtain").

Trigger-Marker..... A dotted line extending through all channels is used to identify the trigger location.

List Mode..... The user can select binary, hex, octal or ASCII code display of active pods in positive or negative logic representation.

Monitor..... The monitor display presents status information (as specified in 4. TRIGGER AND TRACE MONITOR) and comments set ups relating the menu interaction and recording conditions.

1.2 A GUIDE THROUGH THE LAM 4850A SYSTEM ARCHITECTURE

1.2.1 INTRODUCTION

Designed around three independent 16 channel recording blocks (**SBLA** = single board logic analyzer) the LAM 4850A is a modular board system which offers a maximum of flexibility and performance.

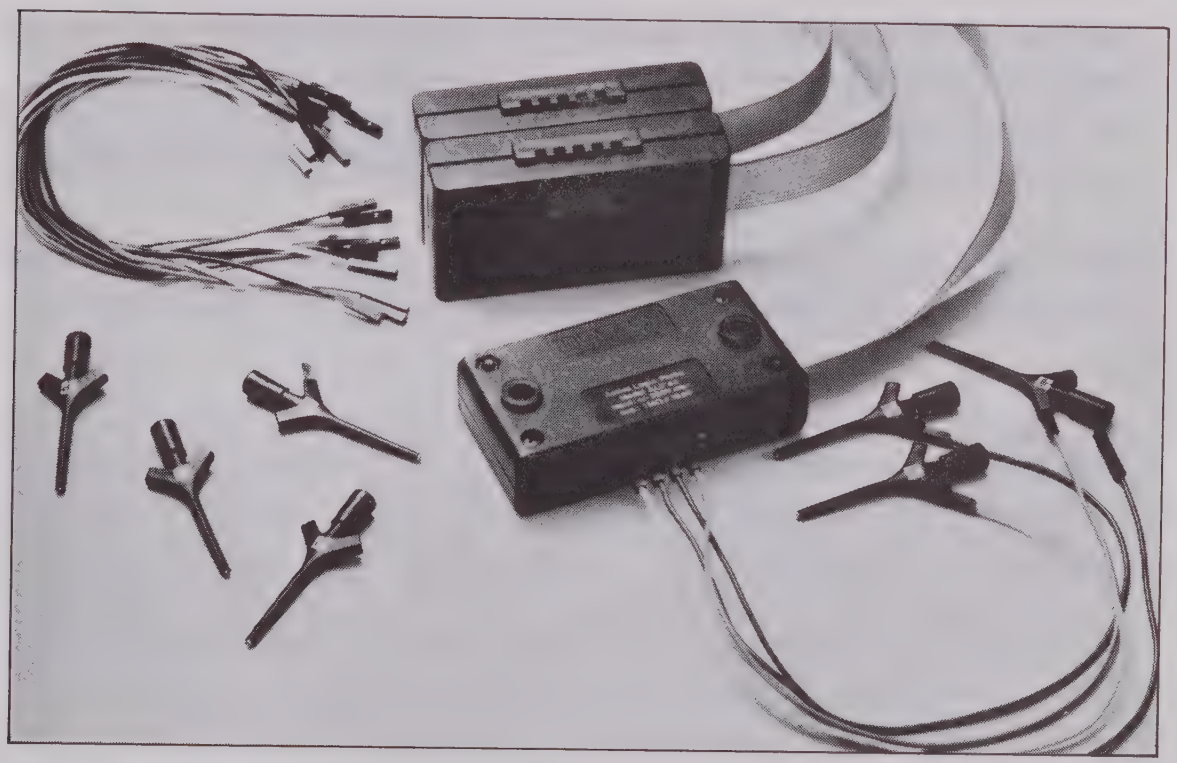
Yet, on the other hand, such a complex instrument can cause trouble, if no one takes care of the overall system architecture (fold out **"LAM 4850 A ARCHITECTURE"** at the end of the manual).

Therefore the following chapters will explain each submodule, yet only as far as is necessary to understand the LAM 4850 A operation. Technical details form the subject of the technical manual. Programming is described in later sections.

1.2.2 DATA ACQUISITION

1.2.2.1 INPUT SENSING

All signals are sensed through a high impedance (1 MOhm//_ 10 pF, measured at probe tip) custom hybrid circuit. Four of these are housed in a probe pod (ALP 44), which can be used stand-alone or mechanically linked to some other pods, configuring groups of variable size.



The input signals will be compared to a threshold level,programmed in the **FORMAT SPECIFICATION** menu. Signals higher thar the threshold level are represented as logical '1', signals lower than the threshold level are shown as logical '0'.

IMPORTANT: Due to the high impedance of the comparator, open signal inputs may catch noise and other signals as a scope probe does. If there is no probe connected, the input connector can generally pick up some noise (crosstalk), too.

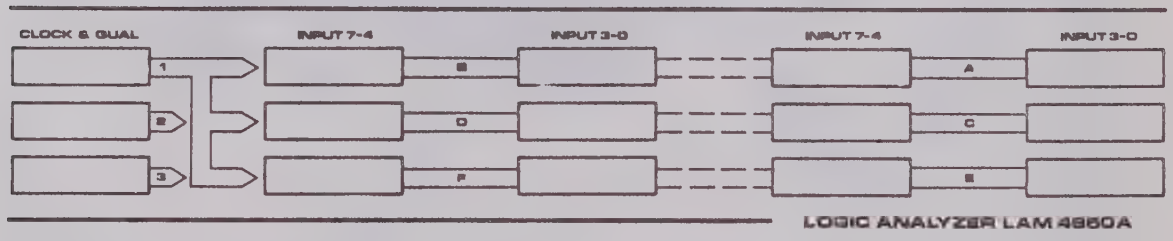
THEREFORE: DON'T USE OPEN INPUTS AS CLOCK, QUALIFIER OR TRIGGER CONDITION.

1.2.2.2 POD ASSIGNMENTS

There are six (A,B,C,D,E,F) data input groups, each 8 bits wide, split into two probe connectors labelled 7-4 and 3-0 referring to the upper or lower nibble of the 8 bit input byte. Supplied with the instrument are signal input probes,also labelled differently, one as upper (U) connected to input 7, 6, 5, 4, and one as lower (L) respectively, serving signal inputs 3, 2, 1, 0.

External clocks and corresponding clock qualifier signals are connected through the same type of probes as data signals.
The clock input is labelled **"CLK"** ,numbers **1,2,** and **3** are used for qualifiers, as designated in the **FORMAT SPECIFICATION** menu.

Data and clock probes are connected to the analyzer front panel according to the notation on the ALP 44 and the front panel.



The graphical illustration here points out the basic LAM 4850 A configuration:

- three independent recording blocks A&B, C&D,and E&F, each consisting of 4x4 channels,
- clock 1 will serve all of them,
- clock 2 serves primarily block C&D and
- clock 3 serves primarily block E&F.

IMPORTANT: ALP 44 pods are labelled differently to show their function. But all are electrically identical and can be exchanged without any restriction !

1.2.2.3 THRESHOLD

There are four threshold sources (TTL = 1,4 volts, ECL = -1,3 volts, and two variable voltages V1 and V2) which can be assigned independently to four groups of active logic probes.

- Data input for recording block A&B
- " block C&D
- " block E&F
- Clock and qualifier inputs.

Thresholds and threshold assignments are programmed in the **FORMAT SPECIFICATION** menu.

1.2.2.4 HOW TO COMPENSATE GND POTENTIAL DIFFERENCES

Each ALP 44 probe is connected separately to the system under test via a "virtual" GND cable. As a result of this, potential differences up to +5 volts between different ALP 44 pods, or between the logic analyzer and the customer's system do not influence threshold adjustments. (i.e. any voltage level from the user's system within +5 volts can be used as GND!)

The GND-shift compensation works properly only if there is a direct connection between the logic analyzer and the system under test, normally via AC-GND.

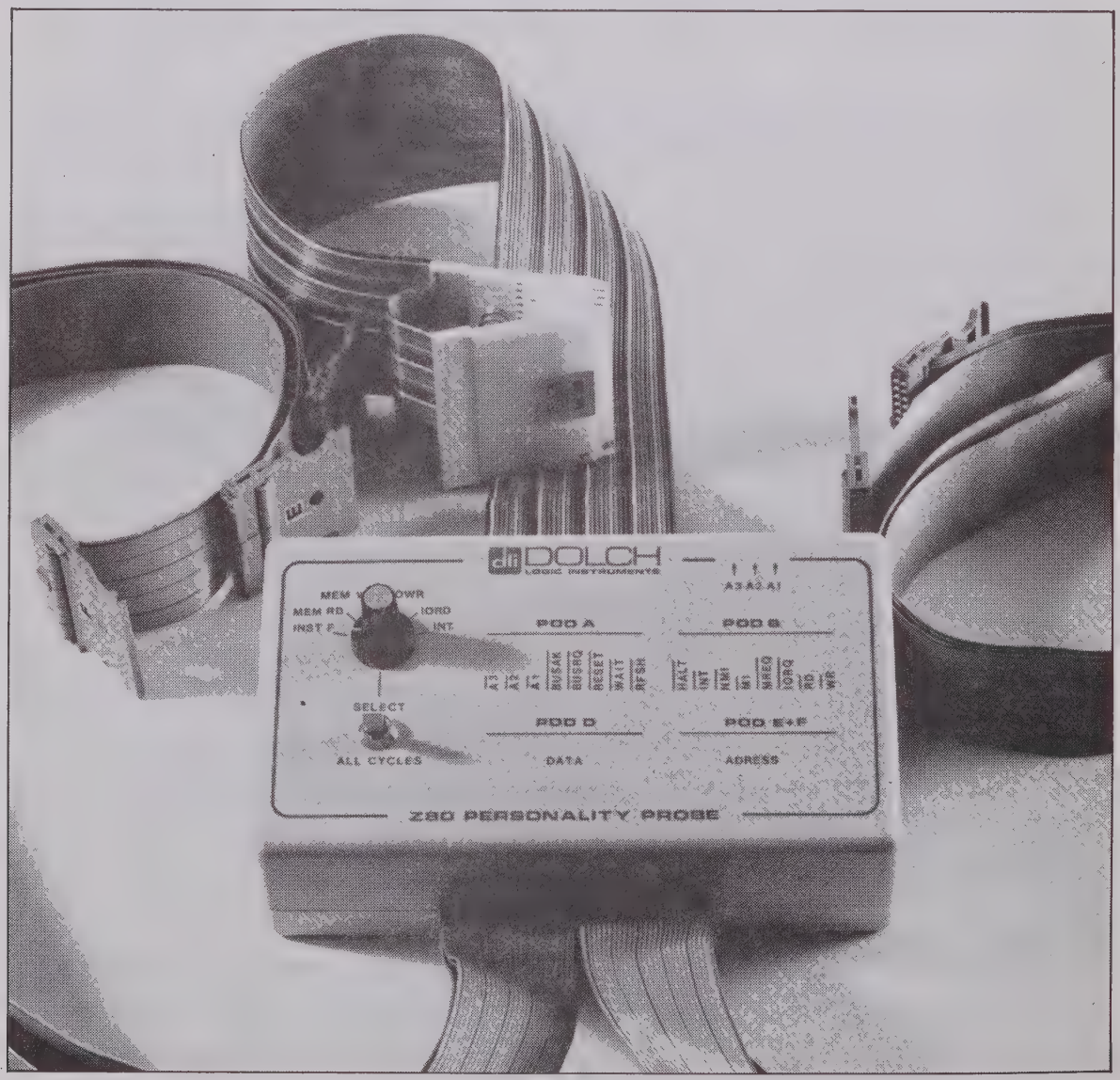
For some applications this connection has to be removed (open top-cover and disconnect yellow/green cable which is screwed at right rear corner of the mother board). Then an additional GND cable has to be added between the logic analyzer's rear connector and the system under test.

IMPORTANT: CONNECT ALL PROBE-GND PINS.

1.2.2.5 THE PERSONALITY PROBE APPROACH

For special multichannel setups the active logic probes can be replaced by personality probes available for many micropoces-sors, IEEE-Bus, and serial interfaces.

The probe is connected via a single clip or connector to the system under test. Whilst this feature alone makes the setup very easy, the personality probe also organizes and generates control signals which are needed to get a clear display and/or disassembly listing.



1.2.3 THREE ANALYZERS IN ONE

1.2.3.1 GENERAL

The LAM 4850 A consists of three identical and independent recording blocks (A&B,C&D, E&F): Each of these consists of an "input board" and a high-speed memory block and may be switched off in the **FORMAT SPECIFICATION** menu, so that the user may disregard some recording parameters belonging to it.

1.2.3.2 THE INPUT BOARD

The first stage within the analyzer is an "input board", through which all incoming data (from the ALP 44 and already digitalised) has to pass. This board is separated from the memory, because the memory is the heart of any Logic Analyzer and has to perform the same function in all applications. The first step in data aquisition may differ due to the customer's request.

The standard input board contains line receivers, D-type latches and, for channel group A&B, an additional glitch capture circuitry.

1.2.3.3 THE SINGLE BOARD LOGIC ANALYZER (SBLA)

The input board outputs are stored in a memory board called the SBLA, which contains some control logic, 16x1 k memory and 3x4 trigger word recognizers. Even if they are not utilized completely in the standard version they can be accessed and controlled by further options.

Whether the SBLA memory is filled with data from the input board depends on the status of an additional qualification control line. In the standard version this line is held in a state so that every event will be stored, but optionally it can be used for sophisticated data qualification.

1.2.3.4 MEMORY FORMATTING

The three recording blocks can be formatted differently:

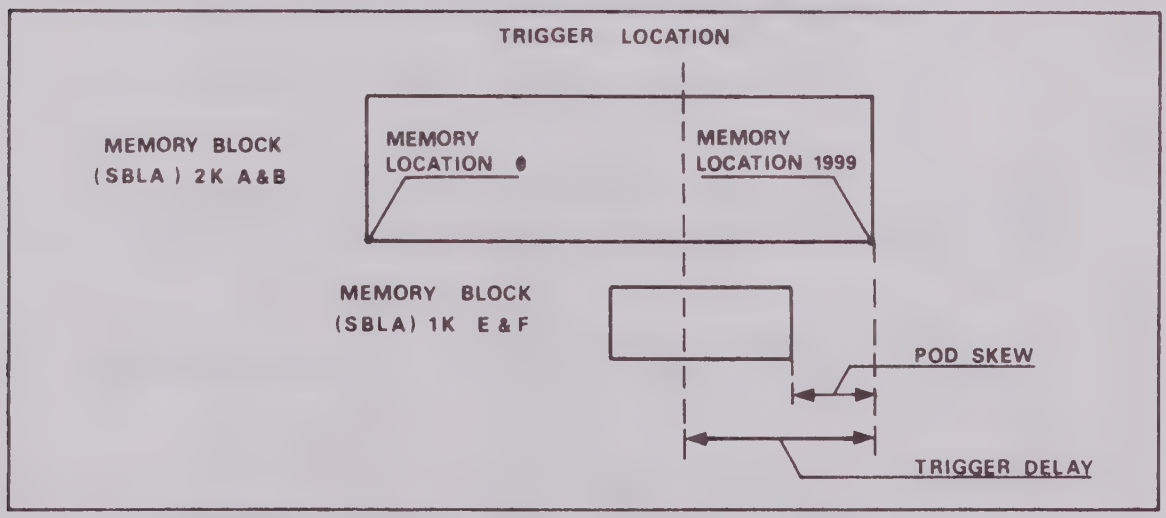
48 BIT MODE:

Three blocks in parallel, each 1K deep.

32 BIT MODE:

Recording blocks A&B and C&D are combined: Input data available to SBLA A&B are also switched to SBLA C&D, and will be written into the SBLA's alternately (= INTERLACE technique). But from the user's viewpoint the memory depth of recording block A&B will be doubled, whilst recording block C&D is no longer available.

Recording block E&F remains the same, but can be shifted relative to the pod-skew parameter defined in the **FORMAT SPECIFICATION** menu.



1.2.3.5 REFERENCE MEMORY

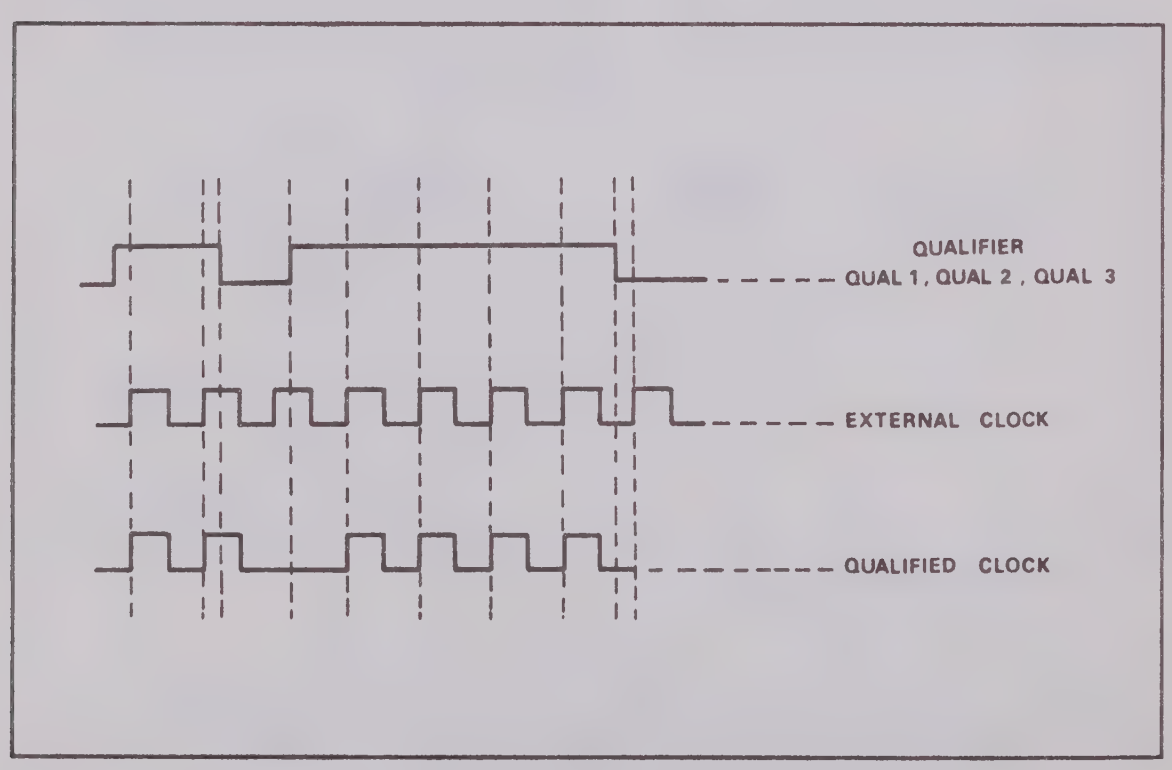
The LAM 4850 A contains a reference memory equal in size to the recording memory blocks. Both can be compared automatically as programmed in the **COMPARE MENU.** Yet this is possible only if both memories are equally formatted (same number of blocks has to be used, same mode, same pod-skew). The reference memory is formatted automatically when the recording memory is copied to the reference memory by a single key stroke.

1.2.4 THE TIMEBASE

1.2.4.1 CLOCK AND QUALIFIER ASSIGNMENTS

Three external clocks (plus qualifiers) and an internal sample clock (50 ns to 500 ms) can be assigned to all recording blocks, each consisting of a SBLA and the input boards. (Programmed in FORMAT SPECIFICATION menu.) THE INTERNAL SAMPLE RATE FOR SBLA A&B IN 32 BIT MODE IS 50 MHZ.

The selected clock edge latches the digitized information on the input board with every active edge, and it makes no difference if a qualifier is selected or not. But only when the selected qualifier combination is true will these data be stored within the SBLA.



IMPORTANT: DON'T ASSIGN DISCONNECTED CLOCK AND QUALIFIER INPUTS: THEY CAN PICK UP NOISE!

1.2.4.2 SPEED LIMITATIONS

The maximum sample rate in 48 Bit mode is 25 MHz, in 32 Bit mode 50 MHz.
The maximum external clock rate is specified for 25 MHz, assuming that different external clocks will be used which are completely out of phase and asynchronous. Note that trouble can be caused in the interaction logic analyzer system under test (interference etc.) if clock frequencies are higher then specified.

With a single clock in the 32 Bit mode however, the user can generally work at recording block A&B with significantly higher clock rates, up to the limits determined by setup and hold times.

IMPORTANT: For each application, maximum recording speed is limited by one or several of the following points:

- max. frequency 50 MHz (32 bit mode)
- setup and hold times
- delays within the user's system
- possible interferences between several external clocks!!

1.2.4.3 OR CLOCKING

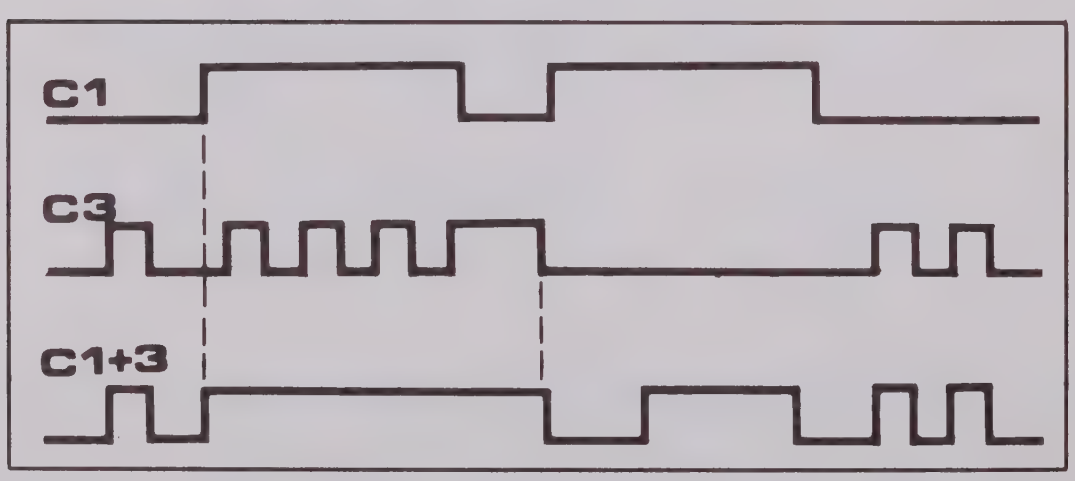
The LAM 4850 A allows the clocking of one SBLA from more than one clock source, tying them together in an OR function.

This is very useful in some cases but can also cause some misunderstanding.

Two items should be noted:

1. Both clocks are tied together in a **boolean** OR-function, that means that the **transition of the complete function** is used for clocking and not the edge of the one **or** the other clock.

2. As a result of the description above: If an external clock pod used for OR-clocking is constantly high, the OR'ed clock is always high and therefore no clock edge can occur.



1.2.5 TRIGGER AND TRACE CONTROL

The control board is used to generate common signals for controlling the complete trace sequence of the Logic Analyzer, (trigger delay, pod skew, interlace). This board is flexible in the sense that any further modification of the SBLA's memory depth, trigger and data qualify capabilities will not influence its operation.

The trigger board receives the outputs of all trigger word recognizers, and/or data-qualification word recognizers, from the SBLA's inputs. It combines them sequentially to perform all sequential trigger functions.

This board can be replaced by an **OPTION** board which increases all standard trigger capabilities and allows complex dataqualifications.

All trigger parameters have to be programmed in the **TRIGGER SEQUENCE** menu.

1.2.6 THE STANDARDIZED INTERNAL COMMUNICATION BUS

All boards with logic analyzer functions are connected to the microprocessor system (Z80) via a standardized internal communication bus. Every board can be changed, modified, replaced or added without affecting the system's architecture, which is the basis for any option planned in future, either as a customer's request or otherwise.

1.2.7 REMOTE CONTROL

IEEE 488 Interface

The IEEE 488 interface controls all functions of the analyzer which can be programmed by the analyzer's keyboard. Furthermore, some options might be accessible only via remote.

The analyzer is listener and talker only and its device address is selectable via an 8-digit switch on the rear panel.

Serial RS 232 interface

The RS 232 interface allows similar control techniques to the IEEE 488 interface.

Cutting System overhead

When controlling the analyzer remotely via a serial interface or the IEEE 488 bus, the complete display system (CRT plus 2 boards) and the keyboard can be disabled or removed. Since data and clocks can be brought to the rear panel, the analyzer can be integrated in a rack as a closed box.

1.2.8 OPTIONS

Altogether there can be five software options assembled at one time, some of them require additional hardware support. A slot in the card cage is reserved for further hardware expansions.

A firmware module must be installed for each option. The microprocessor detects these automatically and shows them in a directory after power up.

1.2.9 FROM START TO RECORDING END

1.2.9.1 INITIAL SETUP CHECK

While programming the menus all parameters are stored within the working ram area of the Z80-CPU-system. When the START-key is pressed, an internal setup check-routine is activated.

- If there is any logical discrepancy between setup parameters, the MONITOR display is brought to the screenwith a few comments in plain language, stating what is wrong and the user has a chance to change his setup.

- If the setup is correct, the parameters will be loaded into the logic analyzers hardware at once and after that the assigned clocks are switched to the memory blocks.

1.2.9.2 WHAT HAPPENS DURING RECORDING

Now the logic analyzers hardware steps through three phases which are typical for each data recording. This can be observed with the **"TRIGGER AND TRACE MONITOR"** - especially, if the analyzer is staying longer at a certain phase. If the **MONITOR** key is pressed while the message **LA IS BUSY SAMPLING** appears, it shows at which recording cycle the analyzer is locked.

- **PRETRIGGER SAMPLING**

  The logic analyzer can be considered as a shift register into which data will be clocked continuously, until a trigger event stops the recording after a preselected trigger delay. To be sure that with a new recording the analyzer is completely filled with actual data, every recording block has to get enough clocks (memory depth minus trigger delay) before it can accept a trigger.

- **TRIGGER TRACE ACTIVE**

When all recording blocks are ready to accept a trigger, the sequential trigger search is started.
During this phase the sequential trigger search steps from sequence to sequence, searching at each level for the programmed trigger conditions. They cause either a jump to the next trigger level or re-start the trigger search from the beginning.
This is described fully in chapter **TRIGGER MENU** and is easy to understand as long as all recording blocks use the same clock, but there is one important fact to be mentioned:

Each recording block searches the trigger word at its input with the assigned recording clock. They can differ in frequency and phase, so that the trigger events comming from each SBLA's word recognizer have to be sampled (synchronized) with a **TRIG WORD SAMPLE CLOCK.** This is needed for the sequential trigger search, which can only perform its function clock by clock. Nevertheless, the results may sometimes appear strange. This is simply because there are really three independent logic analyzers in one box, only linked together with one trigger circuit.

As different clocks can be assigned to channel group A&B, C&D, E&F the defined trigger word need not be in the same memory location for all logic analyzer groups. The sequential trigger logic needs about 5 clock cycles until it can be finally ascertained, that the trigger was found (as described above). This means that for memory blocks where the **TRIG WORD SAMPLE CLOCK** was not assigned, there is a time delay. During this time the information in these SBLA's is shifted through the memory. This depends on the ratio between **TRIG WORD SAMPLE CLOCK** and the assigned recording clock. But when the trigger was found, all memory blocks get a defined trigger delay, counted with their own recording clock.

While "trigger trace active" the **TRIGGER AND TRACE MONITOR** shows exactly at which level the trigger trace locked.

- **TRIGGER DELAY ACTIVE**

When the trigger is found, each SBLA has to sample posttrigger data according to the programmed trigger delay. This delay is counted in clocks, which were selected for recording. That means that each SBLA can stop recording independent of other recording blocks.

IMPORTANT:
If the trigger delay is greater than 4096, the difference is counted as **TRIG WORD SAMPLE CLOCKS.** Only if this part of the delay is finished, then each SBLA counts posttrigger data with its own clock.

1.2.9.3 IDENTIFYING THE TRIGGER LOCATION

When all recording blocks have finished recording, the data stored in the high speed memory is transferred automatically to the source memory, which is part of the µP-memory area.

Then the microprocessor starts a routine which marks the trigger location in the source memory.
This is necessary: As **THEN NOT** trigger conditions are available, the occurrence of a trigger event cannot be flagged in a memory, because only one, two or three clocks after the occurrence of an event, can it be determinded if one of the previous words is accepted as the trigger word.

E X A M P L E :

START A
THEN NOT B
THEN NOT C
THEN NOT D

THE FINAL DECISION CAN BE MADE
THREE CLOCK PULSES AFTER THE
OCCURRENCE OF EVENT A, IF IT IS
AN ACCEPTABLE TRIGGER CONDITION.

Yet, if the analyzer stops recording one might assume that there was a trigger. An internal search routine starts at a certain point to look in memory for the programmed trigger word and to mark it on the display.

At higher frequencies the trigger marker can be shifted slightly whenever the trigger event occurs in very short increments. Then not the first but one of the next words, equal to the trigger words, is marked.

IMPORTANT: The trigger search routine identifies only trigger words, which are synchronous to the **TRIG WORD SAMPLE CLOCK.** This means that only these words can be found at the memory location marked with **TRIG** (refer to chapter 1.2.9.2 section **TRIGGER TRACE ACTIVE.)**

If the user wishes to study the influence of the automatic trigger search he can program the last (fourth) sequential trigger level with **THEN, all words don't care.**

1.2.9.4 THE LAM 4850 A ANALYZING POWER

Now the user can start to analyze his data

a) either by arranging them in data list and timing diagram so that they are represented as clearly as possible(deleting channel(groups), selecting formats,)

b) or let it analyze automatically with search functions (source-reference compare, search a word in memory, search a string of words in memory),

c) transferring the recorded data to the reference memory, to store it there for further comparisons as reference or for history only,

d) transferring the data through GPIB or a serial interface to an intelligent remote station.

1.3 THRESHOLD ADJUSTMENTS

1.3.1 GENERAL

All values have to be measured on **THRESHOLD BOARD.** Refer to **1.4 LAM 4850 A TOP VIEW,** where potentiometers are shown, too.
Notice that parameters programmed in the **FORMAT SPECIFICATION** menu will be loaded into the hardware registers only after pressing the **START** key !

1.3.2 REFERENCE VOLTAGE

- connect voltmeter
  COMMON: left connector to mother board, PIN B 30
  VOLTAGE: 6th IC in top row, PIN 12
- adjust reference voltage to -1.980 volts using **REFERENCE** potentiometer
- reconnect voltmeter for further adjustmenst
  COMMON: left connector to mother board, PIN B 30
  VOLTAGE: same connector, PIN B 6.

1.3.3 ADJUST VARIABLE VOLTAGES

- adjust **V1** = + 5 volts to 1.00 volts using **pot V1**
  check **V1** = - 5 volts which has to be -1.00 volts If there is a deviation of more than 10 mV, readjust reference voltage slightly and control/adjust V1 = + 5 volts again.
- adjust **V2** as described for V1 using **pot V2.**

1.3.4 ADJUST FIXED VOLTAGE

- adjust **TTL** to **0,28** volts using **pot TTL**
- adjust **ECL** threshold to -0,26 volts using **pot ECL**

1.3.5 ADJUST VIRTUAL GND

1.3.5.1 MENU SETUPS

FORMAT SPECIFICATION menu:

Assign internal sample clock and variable threshold V1 to all recording blocks. Select clock threshold V1.

V1 = 0.0 volts

internal clock = 1µs

TRIGGER SEQUENCE menu:

use level 1 as **START**, all words **DON'T CARE.** Then start recording. The analyzer will show continuously **LA IS BUSY SAMPLING.**

1.3.5.2 ADJUSTMENTS

Prepare an ALP 44 pod; open the probe pod and connect a voltmeter:

COMMON = SIGNAL GND

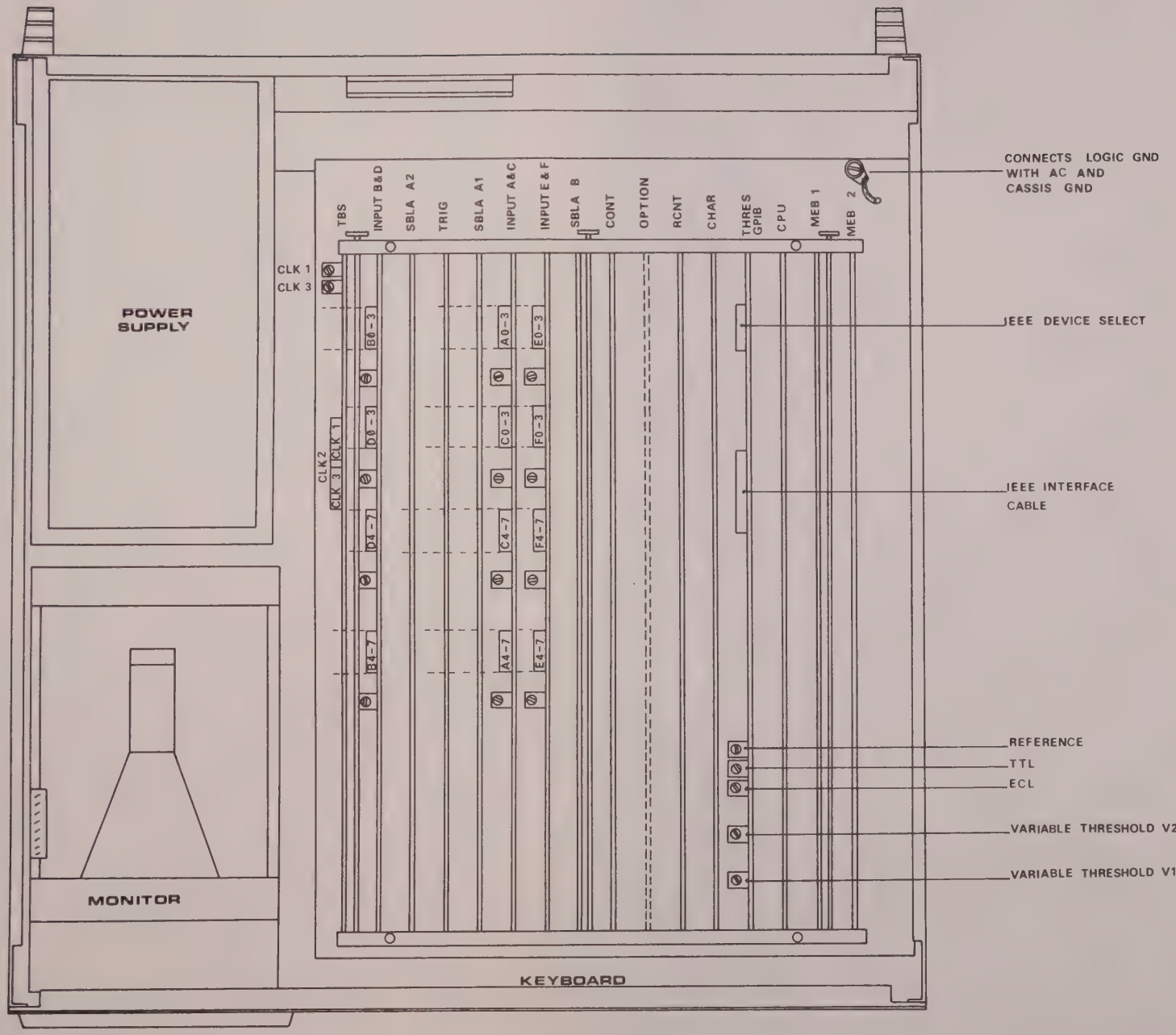
VOLTAGE = HYBRID, PIN 3.

Connect ALP 44 to input connector and adjust voltage to + 30 mV using the potentiometers next to the corresponding connectors on the input boards. (Ref. **1.4 LAM 4850 A - TOP VIEW)**

Adjust clock pods with the potentiometers on the time-base board.

Note that clock 2 does not have its own virtual GND detection circuitry.

CONNECT ONLY ONE POD AT A TIME !



LAM 4850 A TOP VIEW

Before data recording

- How to programm the LAM 4850 A

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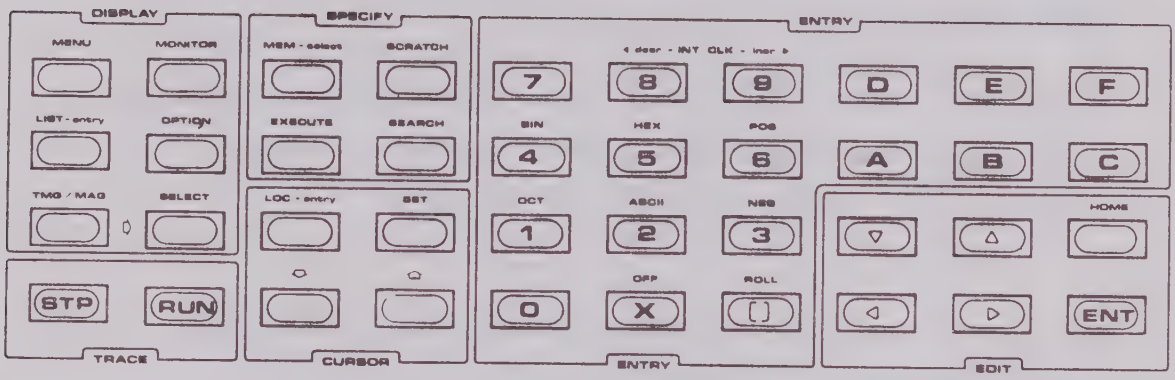
2.1 THE KEYBOARD

The LAM 4850 A uses a keyboard entry system for control of setup and display. The keys are arranged in six functional groups.



- **DISPLAY Group**

  The keys in this group select display of menu, timing diagram, data list, monitor and option table on the monitor.

- **TRACE Group**

  The keys control the start and stop of a data recording.

- **SPECIFY Group**

  The keys in this group are used to select the different memory functions including the scratch memory. The scratch functions are also controlled from this group.

- **CURSOR Group**

  These keys are used to for rolling the cursor in timing and data list and the direct entry of the cursor position.

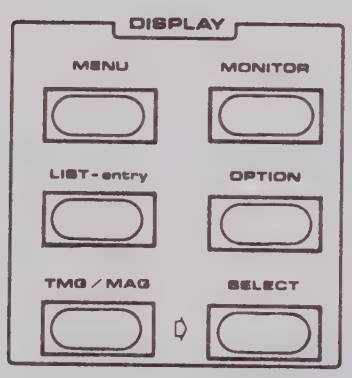
- **ENTRY Group**

  This group is used to input many setup parameters in various ways which are described below.

- **EDIT Group**

  The keys in this field are used to move the cursor while changing setup parameters. The selected parameter is indicated by a blinking inverse-video field.

2.1.1 THE DISPLAY CROUP



MENU KEY

Pressing the MENU KEY causes the display of the **FORMAT SPECIFICATION** . Pressing again causes display of the **TRIGGER MENU** . The next key depression causes display of the **COMPARE MENU** and again display of the **OPTION MENU** . The next key depression brings back the **FORMAT SPECIFICATION** in a cyclical manner.

Whenever the **MENU** selection is left in order to access other functions of the Analyzer, pressing the **MENU** key again will bring back the menu selection, to continue in the same menu as where it left off.

LIST entry

The **LIST** - entry key selects display of the data list. In this way the contents of the data memory of the Logic Analyzer is shown in binary, hex, octal etc.

TMG/MAG

When this key is pressed the contents of the data memory of the Analyzer is shown as a timing diagram in expansion X1 mode.

Repeated key depressions causes display in the expanded X10 and X20 mode for 48 bit configuration and expanded X5 and X10 mode for 32 bit configuration. The expansion is shown from the actual cursor position to the right, while the cursor is fixed on the left side of the monitor.

SELECT

While in **TMG/MAG** (Timing diagram) 16 channals are shown at one time, therefore with the **SELECT** key it is possible to select the group to display on the monitor (A003, C00B, E00F). Repeated pressing changes the display from A+B to C+D and to E+F channal groups, but only if these groups are active. Otherwise the change is made directly to the next active group, eg. C+D are OFF, the change is made from A+B to E+F.

MONITOR

When the **MONITOR** key is pressed the internal check procedure for setup is called and the result is shown on the screen of the Analyzer.

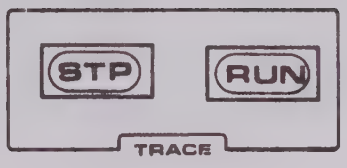
If the **MONITOR** key is pressed while the Analyzer is actively busy for data recording, the actual status of data recording and executing of **TRIGGER** sequences are shown.

Detailed information about the **MONITOR** is contained in the section: The 4850 A Monitor.

OPTION

With this key the enabled option from the **OPTION MENU** is activated.

2.1.2 THE TRACE GROUP



RUN

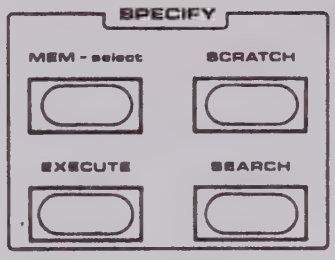
With the **RUN** key a data recording is started, depending on the setup of the Logic Analyzer. If the setup is not correct, so that it is impossible to get data into the Analyzer, the recording does **not** start and the **MONITOR** information is shown on the screen.

STP

Normally the data recording is stopped by the Analyzer. But if there is any external erroneous condition (eg. no trigger word, no external clock etc.) the Analyzer can be stopped by pressing the **STP** (STOP) key.

It is the same if the Analyzer was started while in repeat recording mode.

2.1.3 THE SPECIFY GROUP



MEM-select

Repeated pressing of this key selects different types of memory functions. This selection is only possible in **TIMING** or **LIST** mode. In both modes at the upper right corner of the monitor is placed a field labeled **MEM** followed by an inverse video field.

In this inverse field the actual memory function is described in short form.

More detailed information is available in section:

SCRATCH

By pressing this key the **SCRATCH** table is shown on the monitor. Then it's possible to store or recall different Analyzer setups stored internally in a battery back-up C-MOS memory.

SEARCH

By repeated pressing of this key, different ways of data search are selectable. The first depression of this key changes the **MEM** function field in the upper right corner of the monitor to an **SRCH** label followed by an inverse video field.

In this inverse field the search functions are described in a short form and can be changed by pressing the **SEARCH** key.

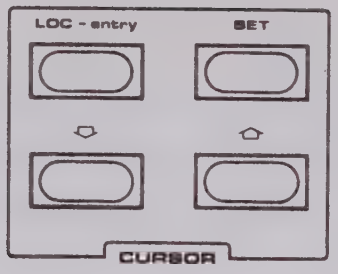
The **SEARCH** function is only available in **TIMING** diagram or **LIST** mode.

More detailed information is available in section:

EXECUTE

All functions in the **SPECIFY** group are started by pressing the **EXECUTE** key. Detailed information is contained in the corresponding section.

2.1.4 THE CURSOR GROUP



The ⇦ and ⇨ keys are used to move the cursor forwards and backwards in **TIMING** diagram and UP/DOWN scrolling in **LIST** mode.

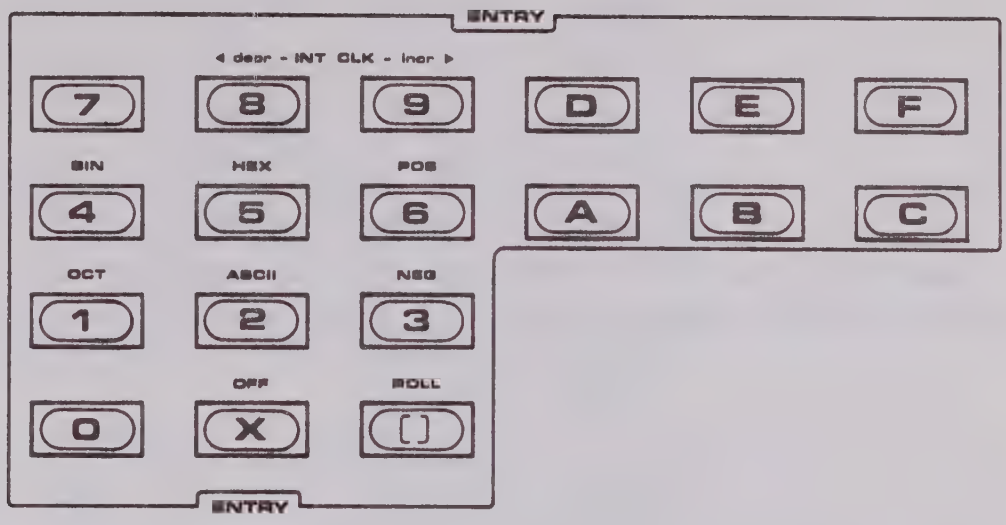
LOC-ENTRY

With the **LOC-ENTRY** key the cursor can be directly controlled by entering a number on the keyboard. This means of direct entry is applicable to both modes (TIMING/LIST).

SET

Every cursor position can be marked by pressing the **SET** key. If then the cursor moves to another position the difference is shown on the monitor.

2.1.5 THE ENTRY GROUP



This group is used to input or change parameters in many display functions of the Analyzer. So the detailed information is given in the relevant description.

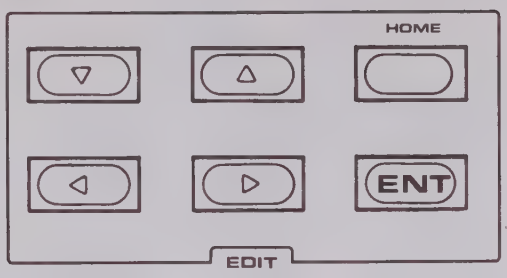
In each case, the first line at the top of the monitor tells the user how to change the parameter.

If there is any incorrect entry (pressing the wrong key) nothing will be destroyed. The Analyzer gives a message to the monitor:

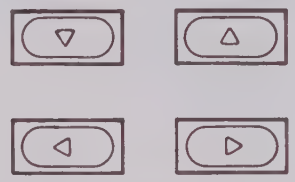
INVALID ENTRY

The user can look at the first line for quick assistance to enter a parameter in a correct way.

2.1.6 THE EDIT GROUP



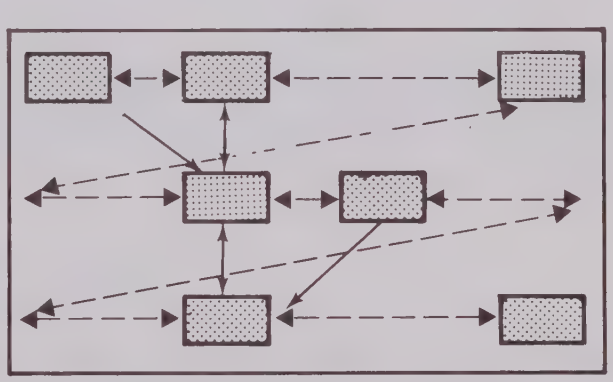
Movement of the edit cursor during menu programming is controlled by the cursor keys:



In menu displays all programmable fields are shown in inverse video. The current position is marked by blinking of this field.

In order to make it easy to move the cursor with these keys, it is important to know how the display is organized:

It is like a line structure From the last most right position to the first position in the next line the cursor can be moved by



It is like a carriage return. This function works also in the reverse direction. Up and down movement sends the cursor to the next possible field in the same direct line.

HOME

In every display mode (MENU, TIMING etc.) there is one position on the monitor defined as the **HOME** position. This position can be programmed by pressing the **HOME** key. The cursor then moves directly to this field independent of the current cursor position.

The **HOME** position is described for each of the different display modes.

ENT

The **ENTER** key is used to input a parameter with a numeric value.

The form is: press **ENT** , then input of one or more digits and press **ENT** again.

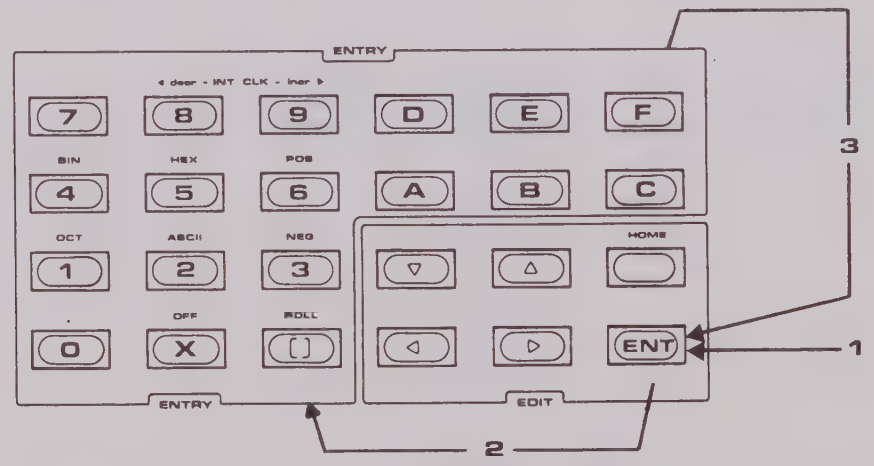
2.1.7 HOW TO CHANGE PARAMETER

The following is an explanation of how to change parameters when programming the Logic Analyzer. There are three types of programmable parameters (fields).

1.) Parameters enclosed in square brackets e.g.:
[TTL] are changed by using the ROLL [ ] key of the **ENTRY** group.

2.) Parameters enclosed in < > brackets e.g.:
[<50 ns>] are changed by using the ◁ deer - INT CLK - incr ▷ 8 9 keys. (increment/decrement) of the **ENTRY** group.

3.) Parameters without any brackets (digital fields) e.g.:
+ 2,4 V are changed by using the **ENT** key, then pressing digit keys in the **ENTRY** group and then **ENT** again.



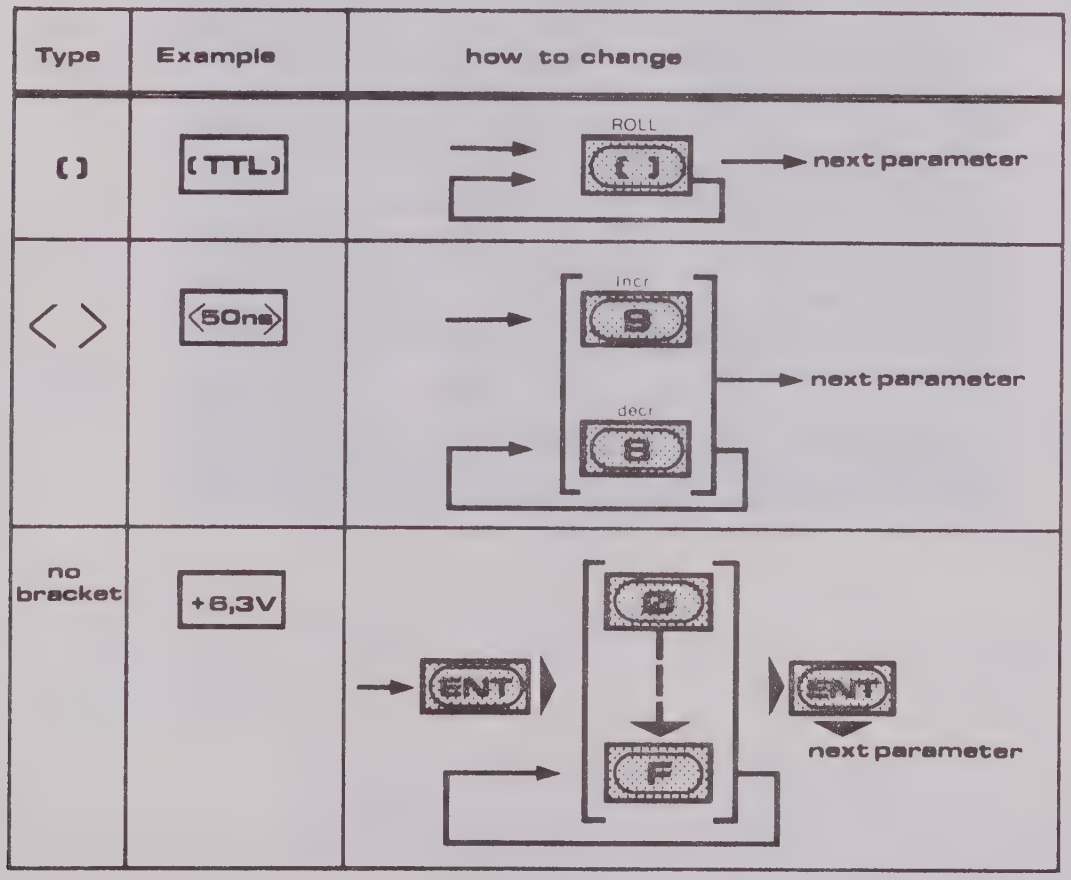
If there is a digital field with several positions e.g. Triggerword in binary [XXX10X11] the **EDIT** cursor control keys ◁ ▷ can be used to skip one or more digits forwards or backwards.

If the field is programmed and the second **ENT** was pressed, the cursor moves automatically to the next programmable field on the monitor.

2.2. TRACE MENU (Recording format specification)

The **TRACE MENU** is necessary to establish the Analyzer's recording format. All programmable parameters and their functions are described in detail in this section.

First of all remember the rules of programming parameters:



Each time the headline of the monitor tells the user the next steps for fast help!

2.2.1 OPERATING MODE SELECTION

This parameter is used to select two different operation modes:

--- [(MAN)] (manual)

a recording is started by pressing the **RUN** key and stopped (if necessary) by the **STP** key.

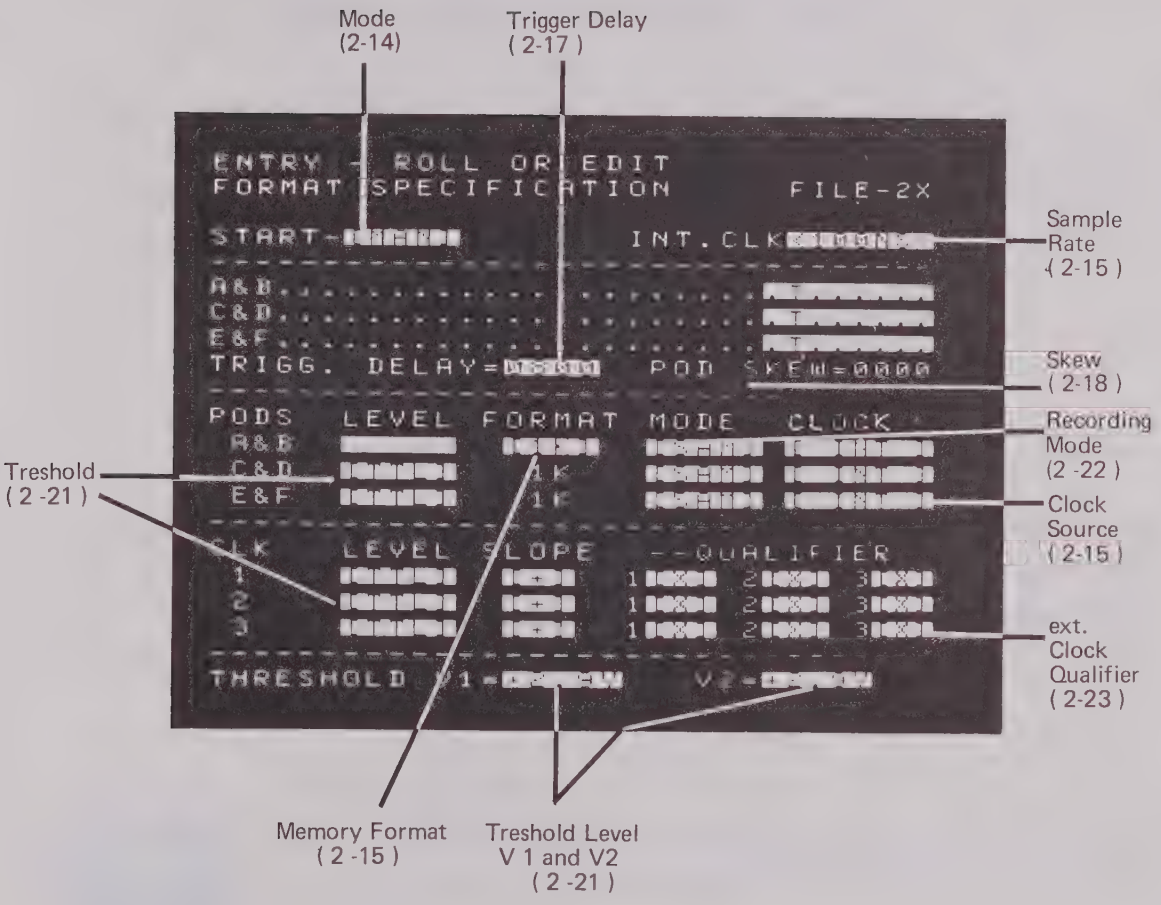
--- [(REP)] ---▶ [OO] sec. (repeat mode)

In this mode, when the [RUN] key is pressed a recording is initiated. After the recording is complete, the next recording will be initiated automatically after a delay, defined in the [OO] sec. field.

This field can be programmed in the range 0 to 99 seconds.

The Analyzer can only be stopped by pressing the [STP] key.

TRACE MENU


Mode
(2-14)
Trigger Delay
(2-17)
ENTRY - ROLL OR EDIT
FORMAT SPECIFICATION
FILE-2X
START-
INT.CLK
A&B.
C&D.
E&F.
TRIGG. DELAY=
POD SKEW=0000
PODS LEVEL FORMAT MODE CLOCK
A&B
C&D
E&F
CLK LEVEL SLOPE --QUALIFIER
1
2
3
THRESHOLD V1=
V2=
Sample
Rate
(2-15)
Skew
(2-18)
Recording
Mode
(2 -22)
Clock
Source
(2-15)
ext.
Clock
Qualifier
(2-23)
Treshold
(2 -21)
Memory Format
(2 -15)
Treshold Level
V 1 and V2
(2 -21)

2.2.2 SAMPLE RATE PROGRAMMING

This parameter is used to select the sample rate of the internal clock.

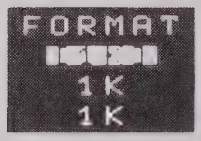
- 50 ns The sample rate is programmable from
  500 ms to 50 ns (1K mode 48 bit)
  500 ms to 20 ns (2K mode 32 bit)

If the sample rate is set to 20 ns in 32 bit mode and the 32 bit mode is changed to the 48 bit mode, the sample rate field is automatically reprogrammed to 50 ns (max. sample rate in 48 bit mode).

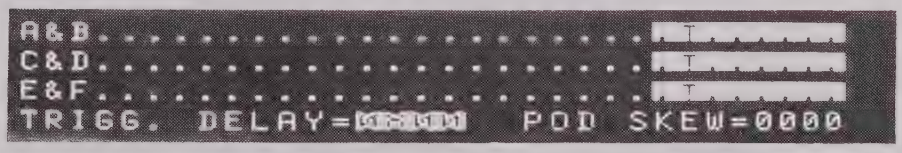
2.2.3 FORMAT PROGRAMMING (internal memory organisation)

In the following section, the monitor is used to illustrate the organization of the data memory. The user has immediate feedback from the results of programming the next three parameters.

- 1 K (48 bit mode)



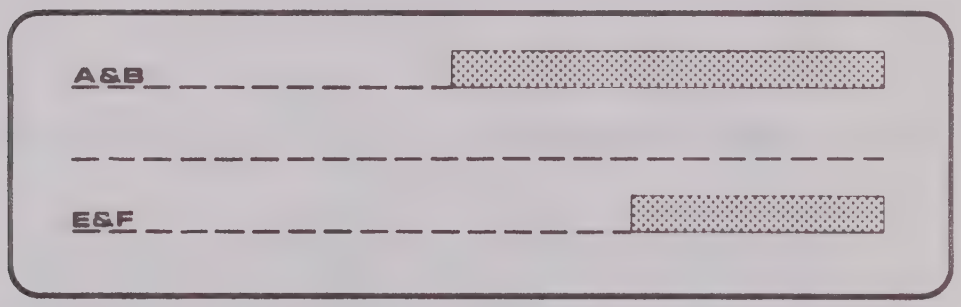
The internal memory structure is 48 bit wide by 1K deep for each channel.



1 K mode (48 bit 1 K memory)

- [2 K] (32 bit mode)

In this mode the 16 bit wide 1 K deep memory of channel group C+D is assigned to channel group A+B. Therefore is now behind the input connector for A+B a 16 bit wide 2 K deep memory. Signals, connected to C+D channel group are not recorded in the mode. The channel group E+F with 16 bit wide and 1 K deep memory is available additionally in this mode.



2 K mode (16 bit 2 K memory A+B +
16 bit 1 K memory E+F)

2.2.4 TRIGGER DELAY PROGRAMMING

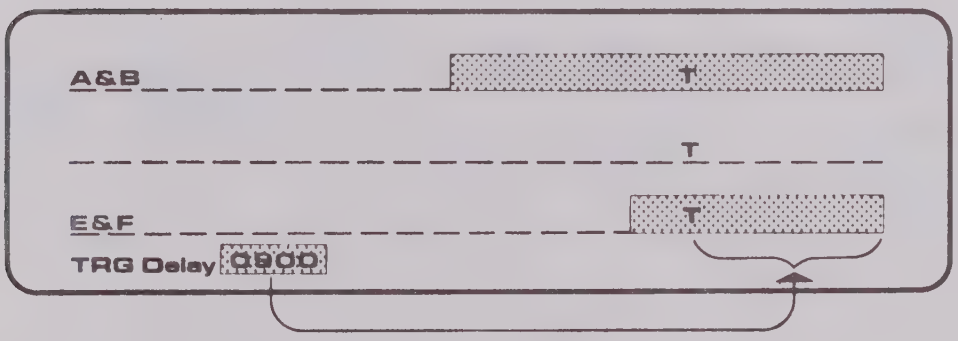
- **TRIG DEL**

The position of the defined triggerword in the data memory can be programmed in this field. The position of the triggerword can also be located outside of the memory.

The programmed number is counted from the right hand side of the figure shown on the monitor. The actual position is marked with a [T] on the monitor. The dotted line in each memory block can be used to count the region where the triggerword is located. The distance between two dots is 125 memory locations.

The max. value of trigger delay is:

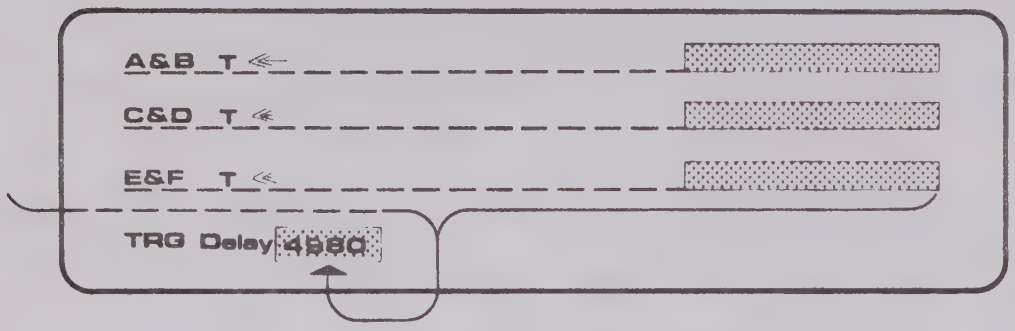
8192 in 1K and 2K mode.



Showing the actual triggerword position in 2K mode.

2.2.4 (continued)

If the triggerword position is defined as a high number and cannot be displayed exactly on the dotted line, the figure looks like this:

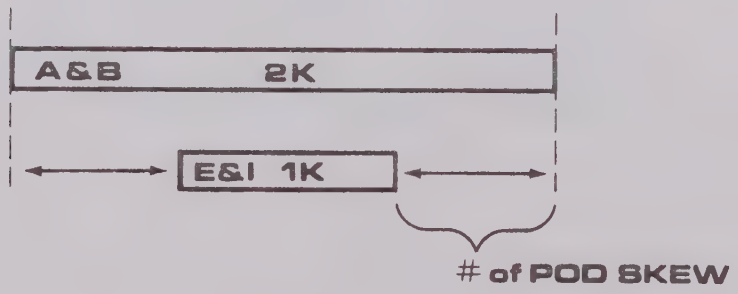


To understand the function of triggerdelay please refer to the basic information.

2.2.5 POD SKEW PROGRAMMING

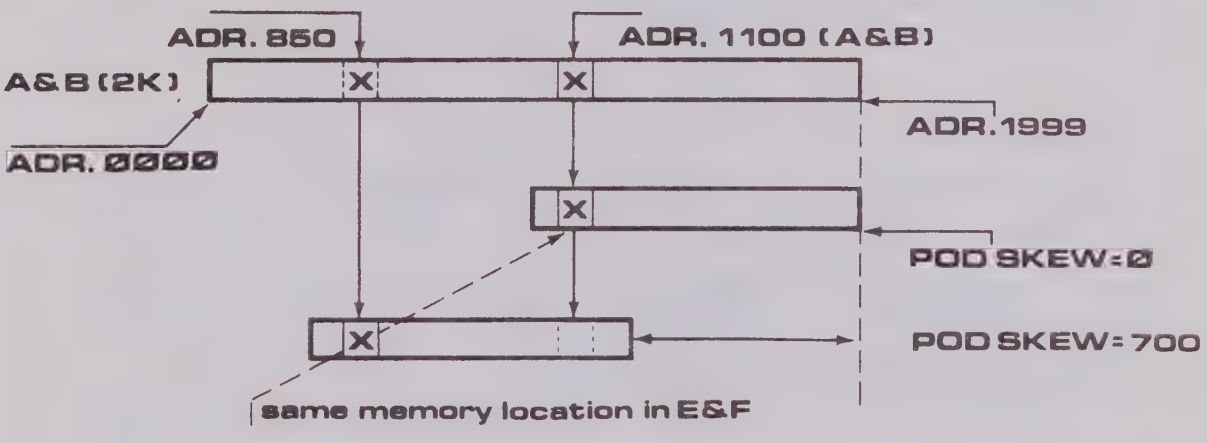
- **POD SKEW**

  This field is only programmable in 2K mode because the parameter can shift the 1K memory of E+F channel group to any position between the boundaries of the A+B channel group.

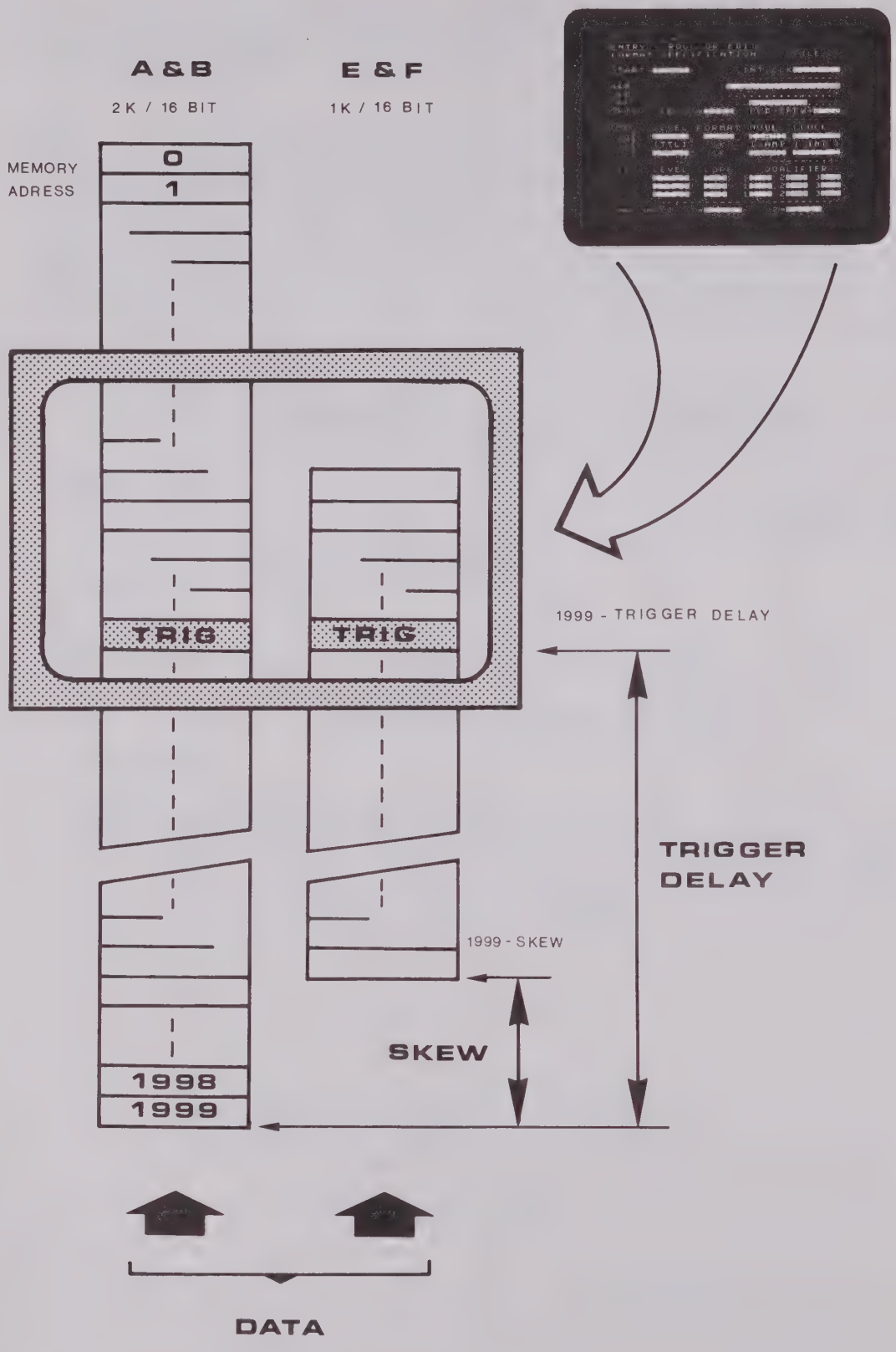


The max. number of **POD SKEW** is 1000. Higher numbers are not accepted. (Message on the monitor: **OUT OF RANGE**).

If in the 2K mode the recorded data are shown in **LIST** or **TIMING** mode, the memory address displayed on the monitor is only assigned to the channel block A+B. So the same memory location in E+F block can be assigned to different address numbers depending on the **POD SKEW** programming.



The complete operation of **POD SKEW** and **TRIGGER DELAY** is shown in figure


A&B
2K / 16 BIT
E&F
1K / 16 BIT
MEMORY
ADRESS
0
1
TRIG
TRIG
1999 - TRIGGER DELAY
TRIGGER
DELAY
1999 - SKEW
SKEW
1998
1999
DATA

POD programming

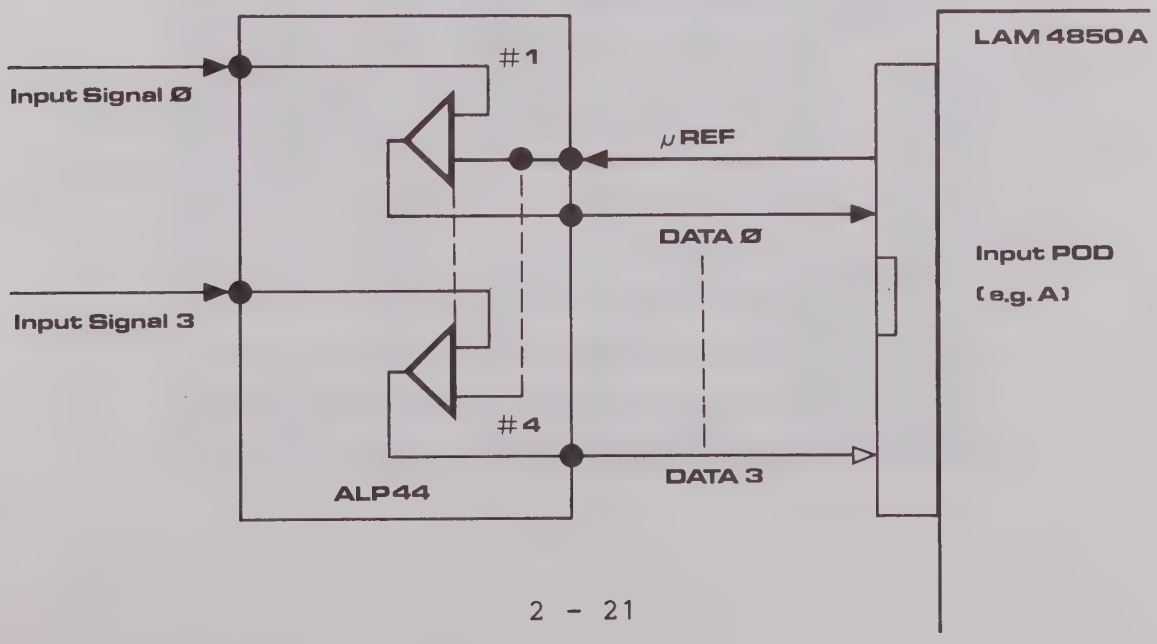
In this section the threshold, the mode and the clock source for each channel group (A+B, C+D, E+F) can be programmed.

2.2.6 THRESHOLD

A+B or C+D or E+F ---→ TTL — fixed level for TTL
ECL — " " " ECL
V1
V2 — two variable voltages

Using the variable **THRESHOLD** (V1, V2) it is necessary to program the respective field (at the bottom of the monitor). The variable Voltage can be set in a range from - 9.9 V to + 9.9 V in 100 mV increments.

It is important to know that the assigned threshold level is sent out to the **ALP's** (Active Logic Probe) and a comparison is made with the incoming signal. Depending on the result, a **HIGH** or **LOW ECL** level is sent back to the analyzer. So if used without an **ALP**, the assigned threshold level has no function.



2.2.7 POD MODE PROGRAMMING

-	POD	[SAM]	Sample mode
		[LAT]	Latch mode (glitch catching)
		[OFF]	POD is OFF

The **LATCH MODE** is only programmable for **POD** group A+B.

2.2.8 CLOCK SOURCE PROGRAMMING

In this field different clock sources can be assigned to the available Pod group.

POD	[INT]	= internal clock
	[C1]	= external clock 1
	[C2]	= " " 2
	[C3]	= " " 3
	[INT+C1]	= internal clock OR ext. C1 are active
	[INT+C2]	= " " " " C2 " "
	[INT+C3]	= " " " " C3 " "
	[C1+C2]	= ext. clock 1 OR ext. C2 are active

SUMMARY

CLOCK SOURCE	POD GROUP		
	A&B	C&D	E&F
INT	X	X	X
C 1	X	X	X
C 2		X	
C 3			X
INT+C1	X	X	X
INT+C2		X	
INT+C3			X
C1 +C2	X	X	X

2.2.9 CLOCK + QUALIFIER programming

In this section the threshold level can be programmed for the external clock and qualifier inputs (three for each external clock). The threshold level can only be programmed for the whole group in one assignment.

- **CLK1** or **CLK2** or **CLK3**
  - [TTL] fixed TTL level
  - [ECL] fixed ECL level
  - [V1] two variable
  - [V2] threshold levels

  Using the variable Threshold (V1, V2) it is necessary to program the depending field (at the bottom of the monitor). The voltage can be set in a range from -9.9 V to 9.9 V in 100 mV increments.

- **SLOPE**
  - [H] ext. clock is active on the rising edge
  - [L] " " " " " " falling edge

  SLOPE can be assigned differently for each external clock.

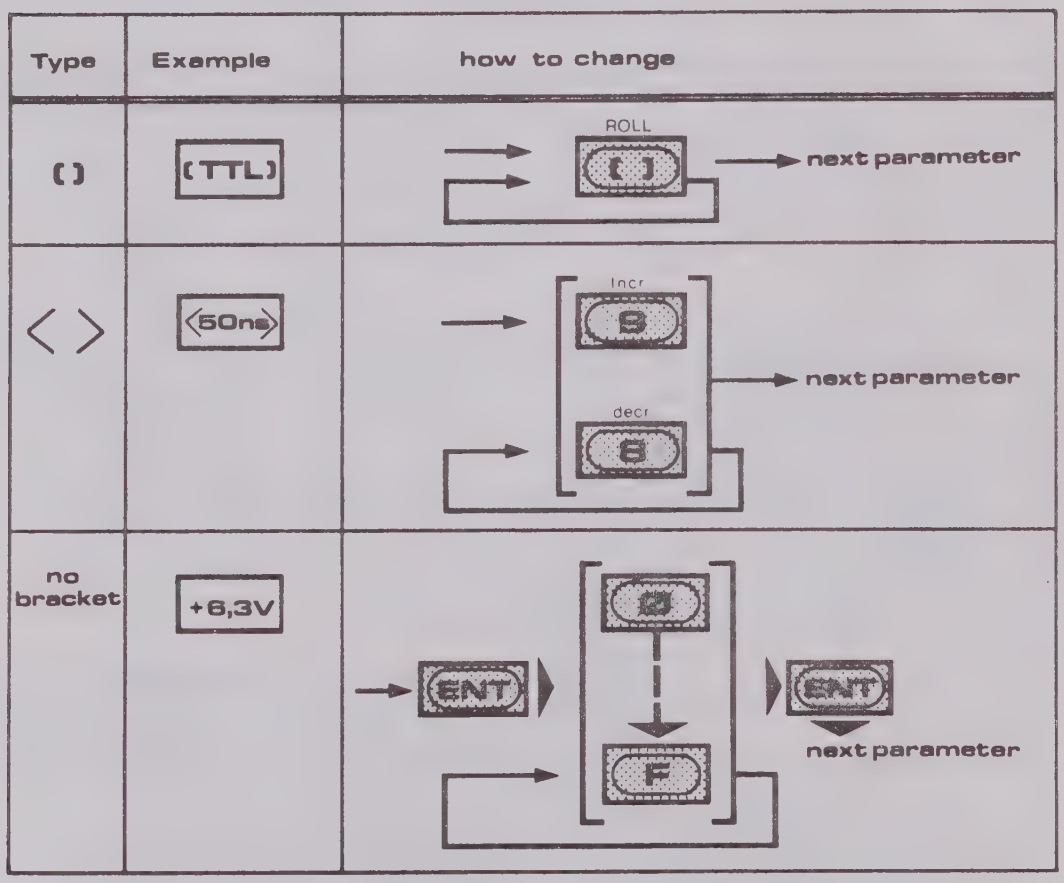
- **Q1** or **Q2** or **Q3**
  - [X] don't care
  - [H] qualifier must be **HIGH** to enable the depending ext. clock
  - [L] " " **LOW**

For each external clock three qualifiers are programmable. The threshold level for the qualifier is the same as for the external clocks.

2.3 **TRIGGER MENU** (Trigger sequence specification)

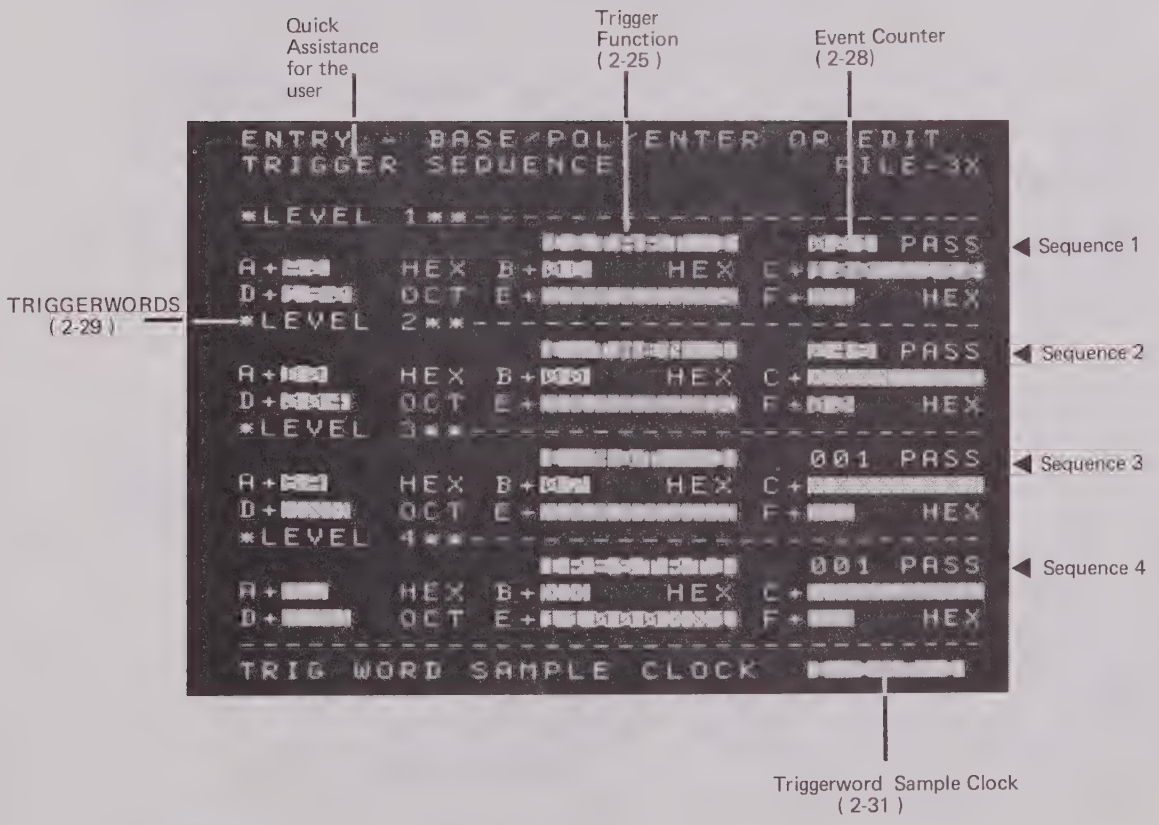
The **TRIGGER MENU** is used to establish the Analyzer's **TRIGGER** words and the way in which the four sequential **TRIGGER LEVELS** are executed. All programmable parameters and their functions are described in detail in this section.

First remember the rules of programming parameters:



Each time the headline of the monitor tells the user the next steps for quick assistance!

TRIGGER MENU



( ) Page of detailed description

The following description is made for one trigger level. The changing of parameters is always the same for each level, except the function of the level.

2.3.1 FUNCTION

(**HOME** position is the function field in the first level)

In this field the user can program in which way the respective levels are executed during triggerword search sequence.

- [OFF] (level 2, 3, 4)
  This level is turned off from the trigger sequence. Programmed triggerwords are internally disabled. This means that to skip one level in the trigger sequence, only **OFF** function is necessary without resetting the triggerwords.

- [FREE RUN] (only level 1)
  No trigger sequence is executed and no search for programmed triggerwords. By pressing the **RUN** key in this mode the Analyzer fills the internal memory with data present at the inputs and then stops the recording.

- [START] (only level 1)
  The analyzer is looking for the programmed triggerword in this first level.

- [THEN] (level 2, 3, 4)
  If the analyzer has executed an active level before **THEN** it now searches for the triggerword programmed in this level.

- [NOT] THEN NOT (level 2, 3, 4)
  If the analyzer has executed an active level before and the programmed word in this level does **NOT** follow immediately, this function is true and the level is executed.

  If the programmed word follows immediately, this function is not true and the analyzer returns to level 1 for executing the whole sequence again.

- [RESTRT] RESTART (only level 4)
  If the analyzer has executed the first level completely, then he executes the next active level. If restart is programmed, it also looks for this function. Independent of the execution of the programmed trigger sequence, if this triggerword (restart) is found, the analyzer cancels the execution of the sequence and starts again at the first level, to execute the whole sequence again.

Summary of programmable functions

	Level 1	Level 2	Level 3	Level 4	Event Counter
OFF		X	X	X	1 - 255
FREE RUN	X				no function
START	X				1 - 255
THEN		X	X	X	1 - 255
NOT		X	X	X	1
RESTART				X	1

2.3.2 EVENT COUNTER

- **EVENT** [001]

This counter is programmable from 1-255 events. The programmed triggerword must be found this number of times before the analyzer passes to the next active level.

There are some restrictions for programming this counter, depending on the programmed function. These restrictions are listed in the summary table for the functions.

Also the minimum value must be 1; programming a 000 causes an error message (OUT OF RANGE) when the [ENT] key is pressed. In this way the [ENT] is not accepted to correct the value.

At functions where the counter must have a 001 (**THEN NOT, RESTART**) the field is disabled for programming (inverse video is suppressed).

If a number higher then 001 is programmed and the function is changed to **THEN NOT** or **RESTART**, the default of 1 is set automatically. By programming this function to e.g. **THEN**, the old programmed number is also recalled automatically.

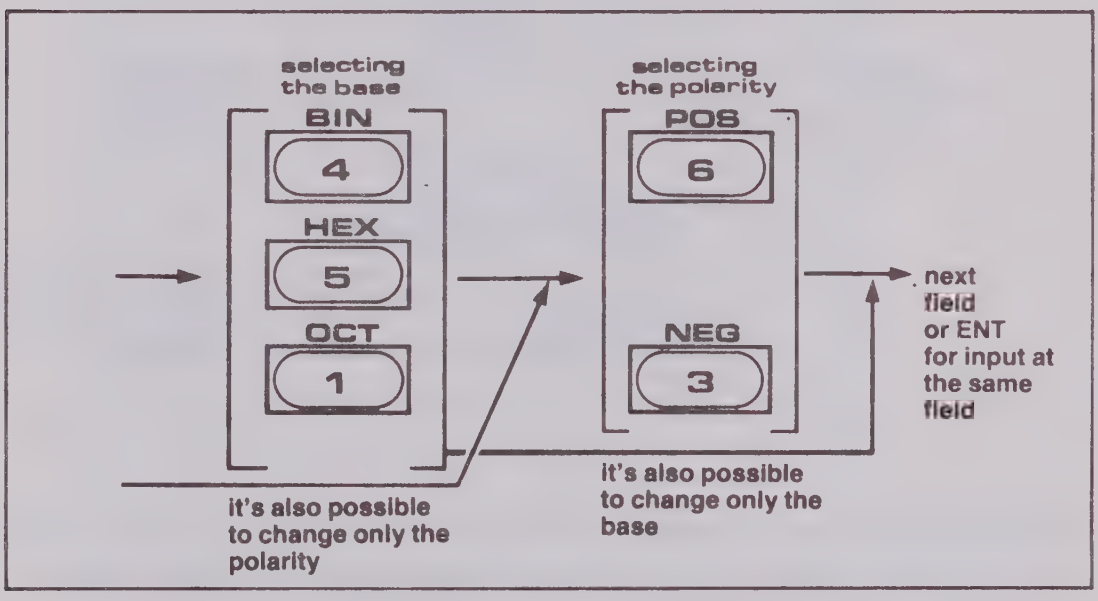
The same is true when the function is switched **OFF** and later switched back to e.g. **THEN** or **START**.

2.3.3 TRIGGERWORD BASE PROGRAMMING

At every tigger level it's possible to program a 48 bit Triggerword. (A,B,C,D,E,F).

Before the programming can be done, the cursor must be moved to the field of interest by using the keys of the **EDIT** group. The selected field then starts blinking. At this point it is possible to change the base for the triggerword to **BINARY, HEX** or **OCTAL** in positive or negative logic levels.

How to do it?



Refer to the headline of the monitor for rapid help!

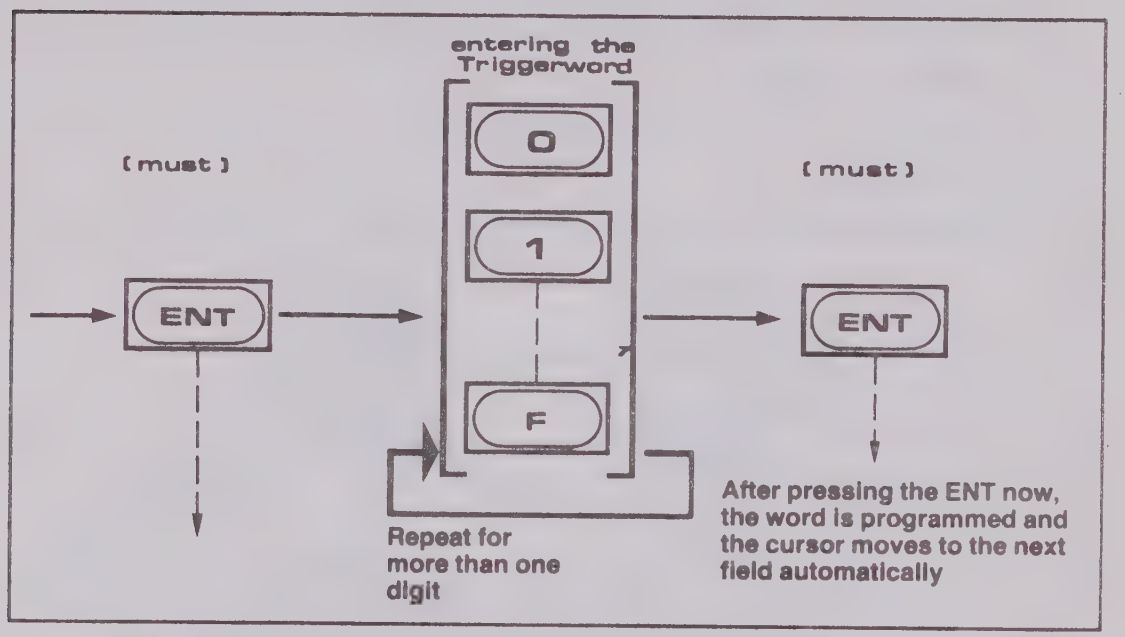
The change can be done at any position in any level for any **POD** group (A,B,C,D,E,F), then the change is made for the selected **POD** in every level.

Programmed triggerwords are automatically changed to the next new base and polarity.

2.3.4 TRIGGERWORD PROGRAMMING

First the cursor must be moved to the field of interest by using the keys of the **EDIT** group. Then this field starts blinking. Now it is possible to enter the trigger-word depending on the programmed base.

How to do it?



After pressing the [ENT] key the blinking of the whole field changes to blinking of the digit now available to program.

The [◁] [▷] keys can be used to skip positions of the Triggerword field.

2.3.5 TRIGGERWORD SAMPLE CLOCK PROGRAMMING

In these fields the clock for triggerword sampling can be programmed. If the defined clock or combination of clocks are active (depending on the **TRACE** Menu for ext. clocks) the internal **triggerrecognizer** now looks at the incoming data of the active **POD** groups for the defined Trigger sequence.

Triggerword Sample Clock

[INT]	Internal clock
[C1]	Ext. clock 1
[C2]	" " 2
[C3]	" " 3
[INT+C1]	Internal clock or ext. clock 1
[INT+C2]	" " " " " 2
[INT+C3]	" " " " " 3
[C1+C2]	Ext. clock 1 or ext. clock 2

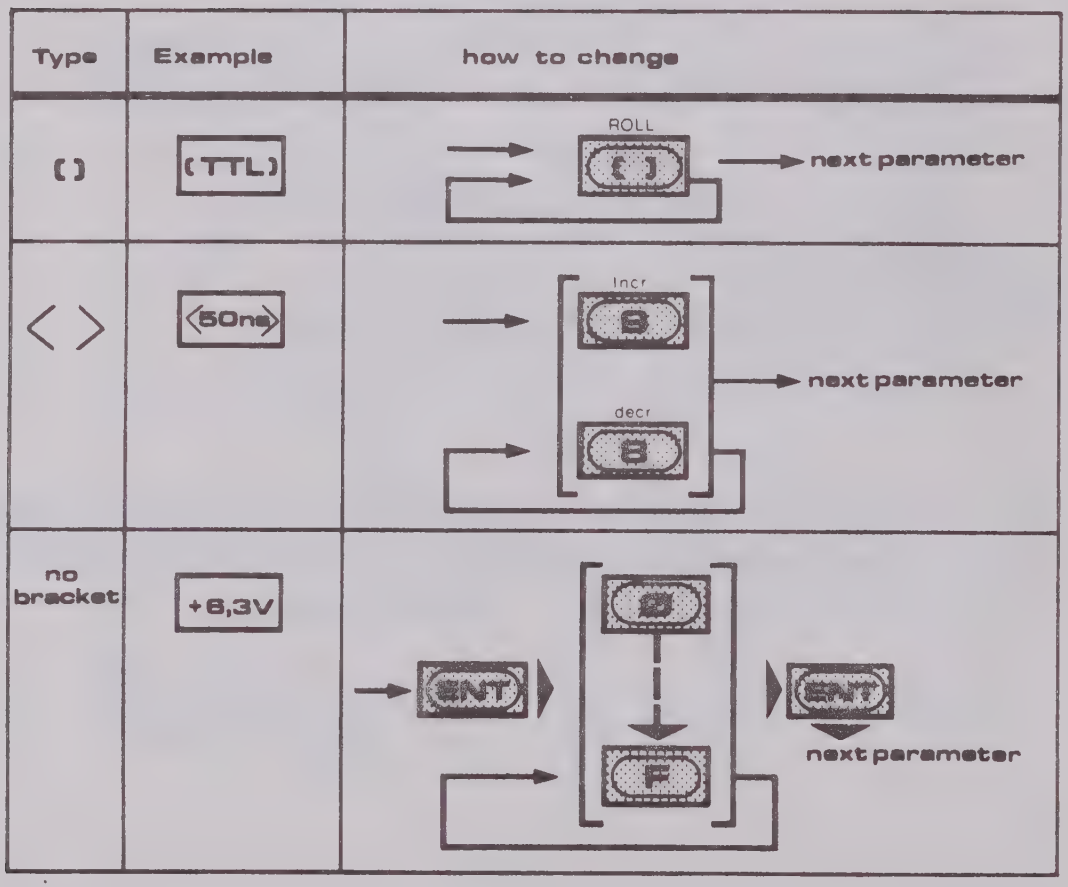
It is important to know that the assigned clock source for the **TRIGGERWORD SAMPLE** must be assigned also to one of the active **POD** groups **(TRACE MENU).**

2.4 COMPARE MENU

The **COMPARE MENU** is used to establish the Analyzer's **COMPARE** parameter for automatic compare action.

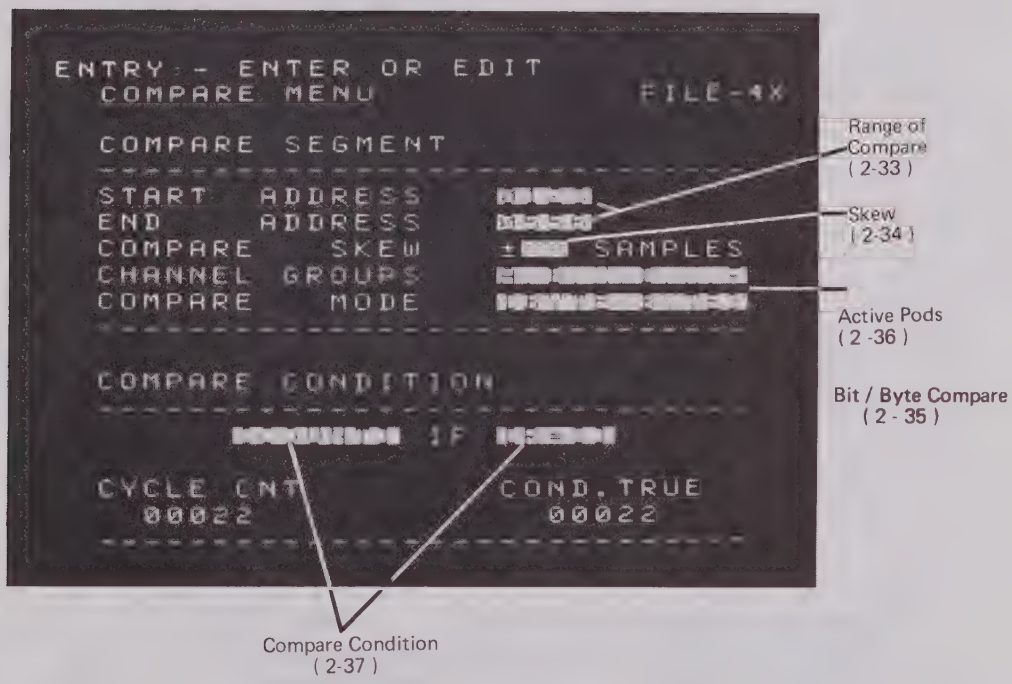
All programmable parameters and their functions are described in detail in this section.

First of all remember the rules of programming parameters:



Each time the headline of the monitor tells the user the next steps for quick reference!

COMPARE MENU



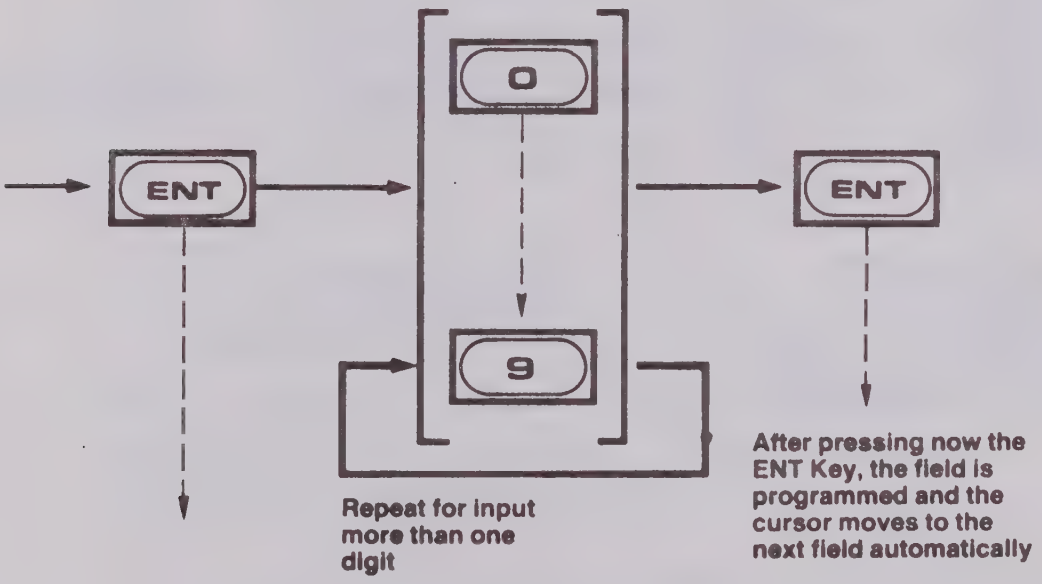
( ) Page of detailed description

2.4.1 PROGRAMMING THE RANGE OF COMPARE

Programming the **START** address (**HOME** position) (Where the compare begins in the internal memory)
and
programming the **END** address
(Where the compare ends in the internal memory).

Moving the cursor to the field of interest by using the cursor control keys [▽] [△] [◁] [▷] from the **EDIT** group. The whole field starts blinking.

Now it is possible to program the address in the following way:

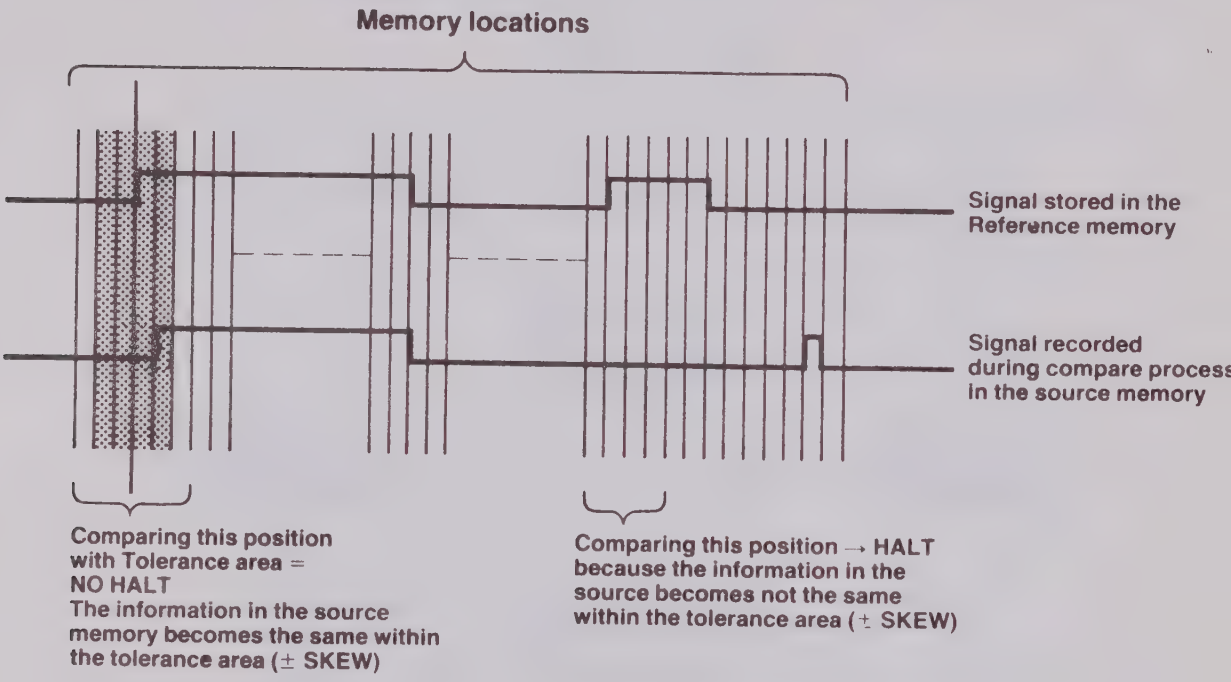


After pressing the [ENT] key the blinking of the whole field changes into blinking of the digit now programmable.

Both cursor control keys **LEFT/RIGHT** can be used to skip positions of the digits.

2.4.2 SKEW PROGRAMMING

SKEW allows the user to set a tolerance from 1 to 9 samples around every memory location. In this tolerance area the information in the two memories (Reference and Source) does not have to fulfil the programmed compare condition (= or ≠). Example: (Condition is HALF if R/S, Skew = B).



The means of programming is similar to that of the address fields (ENT, digit (Ø-9), ENT).

2.4.3 BIT/BYTE FIELD

BIT/BIT

Compare skew is e.g. ± 2 samples max.

Compare skew is ± 99 samples.

MEM LOC	SOURCE MEM	REFERENCE MEM	COMPARE
0050	00000001	00001010	false
0051	00100010	11110000	false
0052	00010011	10010001	true
0053	10110100	11000000	true
0054	00110001	01110001	true
0055	11110110	00000000	false

A very simple example for the use of the Bit/Bit Compare Mode may be the control of the handshake lines during data communication.

BYTE/BYTE

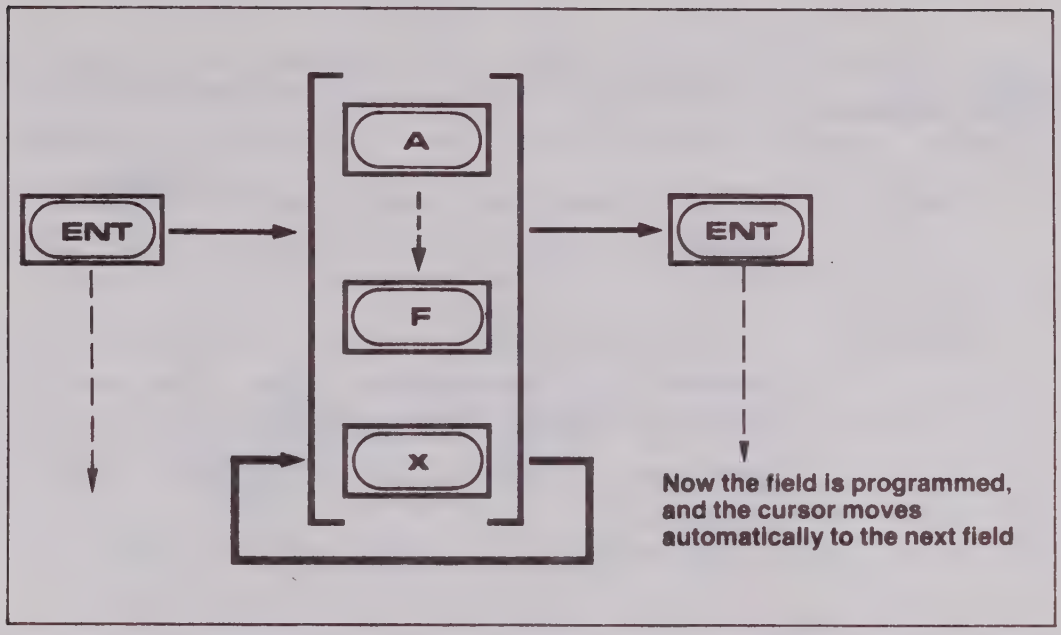
Compare skew is ± 2 samples.

Compare skew can be up to ± 99 samples.

MEM LOC	SOURCE MEM	REFERENCE MEM	COMPARE
0050	10010000	10001001	false
0051	00000111	00001001	false
0052	00001111	10010000	true
0053	11010001	10011001	true
0054	10011001	00000000	false
0055	11111111	10110111	false

An example for the use of the Byte/Byte Compare Mode may be the check of the busactivities during the data transfer between two µP systems.

2.4.4 ACTIVE POD PROGRAMMING



After pressing the **ENT** key at this time the blinking of the whole field changes into blinking of the position now programmable.

Any **POD** can be programmed in each position. After pressing the **ENT** key again, the programmed **POD** is assigned automatically to the right hand position. **ONLY** the position of programming is set to **X** (disable) if this position does not correspond to the programmed **POD** .

X means disable this **POD** for compare process.

2.4 5 COMPARE CONDITION

In the first field the user can program the running of the **COMPARE** .

- [HALT] if the condition (next field) is true, the **COMPARE** is stopped for analyzing the data.

- [COUNT] if the condition is true, "condition true" counter is incremented. Then the next recording starts automatically. To stop the Analyzer in this mode the STP key must be pressed.

In the second field the condition for **COMPARE** can be programmed.

- [R ≠ S] if the data of reference and source memory are unequal, the **COMPARE** follows the condition of the first field.

- [R = S] if the data of reference and source memory are equal the **COMPARE** follows the conditions of the first field.

In both conditions refer to **SKEW** programming.

2.4.6 STARTING THE COMPARE

The **COMPARE** process can only be started when the **COMPARE MENU** is displayed on the monitor before pressing the **RUN** key.

There are two counters at the bottom of the monitor.

The **CYCLE COUNTER** is incremented at every recording during the **COMPARE** .

The **COND. TRUE** counter is incremented after every true condition field.

Any recording during the **COMPARE PROCESS** is made in accordance with the set up in **TRACE** and **TRIGGER MENU.**

The recording and the LAM 4850 A Monitor
- How to get real data

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3. THE 4850A MONITOR AND THE RECORDING

3.1 CONTROL THE PROGRAMMED SET UP

For the greatest flexibility the LAM 4850A allows the user to program many parameters in different combinations.
As a result there could be a combination of parameters programmed by the user performing an erroneous recording without any message. So there is the danger the user may search for an error in the system under test, but this error occurs up during programming the parameter setting of the LAM 4850A.

Without diminishing the flexibility of this instrument Dolch Logic Instruments have now introduced a new method of checking out the logic analyzer before the user starts the instrument for recording.
At any time during programming the parameters of the 4850A the user can call the MONITOR function by pressing the MONITOR key of the **Display Group**

At this instant the internal software is testing the combination of programmed parameters and then sends a message to the display to give information about the programming status. This information has two conditions:

1) The programmed parameters (also called SET UP) are valid.

2) The SET UP's are invalid.

The first part the caption contains the message "VALID SET UP" and then the user gets a short summary of the programmed parameters.

In the second part the headline contains the message "SET UP RESULTS" and means there are parameters in an invalid combination. Then the user gets precise information about the invalid condition. (Examples are shown later in this chapter.)

Testing the programmed parameters tests the relationship between all parameters at instant of calling the monitor function. The monitor can only control the parameters relating to the internal structure of the LAM 4850A and does not monitor any problem external to the LAM 4850A.

NOTE: The Monitor function serves primarily to guide the opertor against invalid set-ups of the LAM 4850A and cannot detect errors beyond the scope of invalid instrument set-ups.

This is a method assisting in the correct recording of data without confusion during the later analysis of the data.

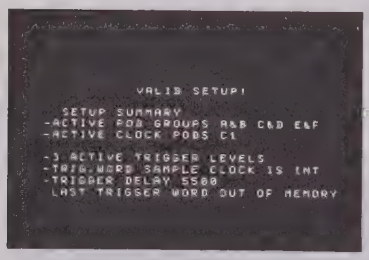
Calling the monitor by pressing the MONITOR key is not essential, it is an aid during set-up.

At the instant where the user starts the 4850A data recording, the analyzer **automatically** controls the programmed parameters before it starts the data aquisition.

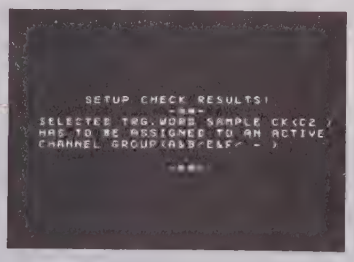
3.1 (continued)

If there is any wrong combination of parameters the LAM 4850A never starts the data recording and sends a message to the screen to inform the user about the wrong recording condition. It is like an user formed monitor call, but only if there is a wrong condition the user gets the message about it.

EXAMPLES:



SET UP OK



Wrong SET UP

3.2 CONTROLLING THE STATUS OF THE ACTIVE LAM 4850A

The second function of the monitor is the **Trigger and Trace control.** It means, after starting the 4850A the Analyzer sends a message to the display "Logic Analyzer busy sampling". If now the analyzer never can finish the data recording depending of external condition, the user can call the Monitor again by pressing the MONITOR key.

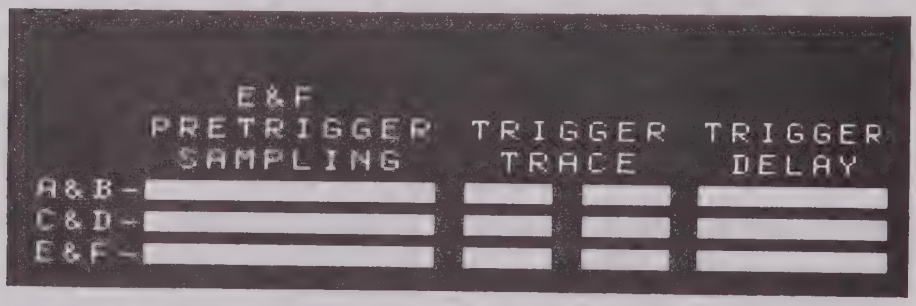
Then the analyzer sends an information to the display containing the internal status of the actual data recording.

3.2.1 TRACE MONITOR

First of all there is the information about the trace status (data recording) shown in a symbolic form at the upper part of the display (see figure)

Like the trace menue the three single board logic analyzers (A+B/C+D/E+F) are illustrated by the three horizontal bars, depending on the programmed memory format in the trace menue (1k or 2k). However, this part is divided in three parts representing the three most important steps of a data recoding.

At the left hand side:	PRETRIGGER DATA
in the middle:	TRIGGER TRACE
at the right hand side:	TRIGGER DELAY



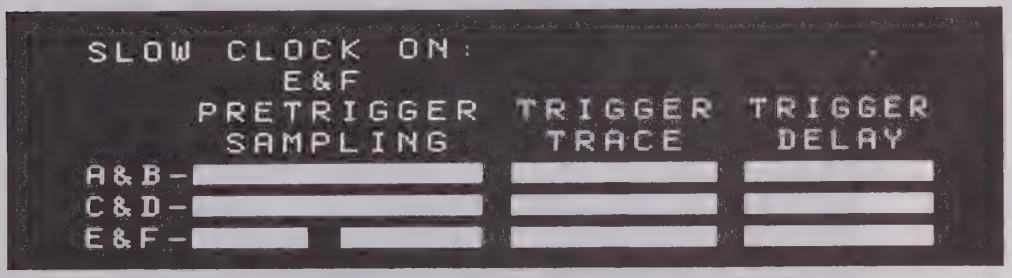
For exact information about this steps of data recording refer to section 1.2.9: From start to recording end.

For immediate feedback of the trace status the monitor now illustrates the active step by blinking a square field in the middle of the depending bar (for example in figure : the trigger trace is active.)

3.2.1 (continued)

Because the user has the flexibility to program different clock sources to the different SBLA groups it could be the internal clock is active at e.g. A+B and C+B and an external clock is assigned to E+F but, depending on external coditions this clock is not active or it is a very slow clock. So the sampling of pretrigger data is finished for A+B and C+D very quickly (because the internal clock is always active) but not finished for E+F.

Now the display gives this information very understandable and exactly to the user



At this recording condition the monitor program sends an additional message to the display:
SLOW CLOCK ON nnnn (nnnn is the label of the depending SBLA groups).

This message can have two different meanings:

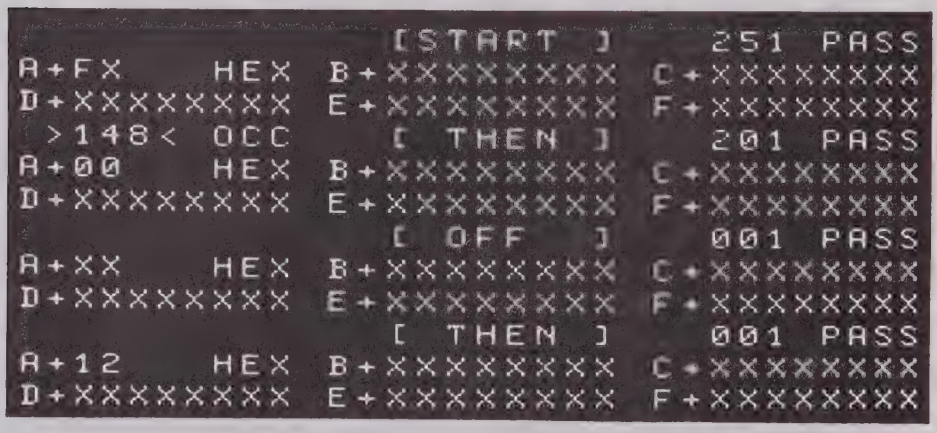
1) really no clock
2) a very slow clock.

To get the right imformation the user can watch this message on the display. If there is a very slow clock this message is time by time flickering at the same moment where the clock edge is active. So the user can really make a difference between slow and no clock.

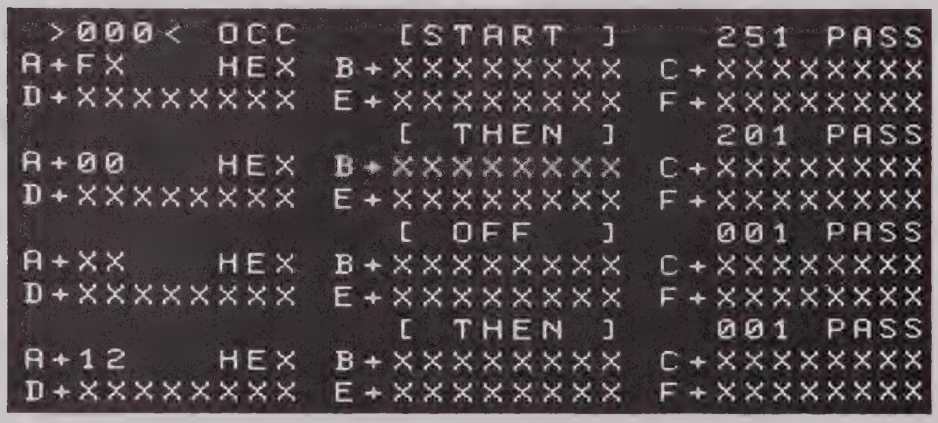
3.2.2 TRIGGER MONITOR

The last part of the display represents the programmed trigger menue with the actual execution of the trigger sequence.

If the recording status becomes TRIGGER TRACE (e.g.figure) the user can now follow on line the execution of the trigger sequence and if there is any wrong external condition (e.g. the programmed trigger words are not recognized) the trigger monitor shows exactly the point where.



The execution of an active triggerlevel is illustrated by the actual size of the pass counter. The programmed value of the pass counter is shown at the right hand side at every level. If a level is actually executed the actual size of the pass counter is shown at the left hand side in the same line but only in the actual active trigger level (see figure).



3.2.2 (continued)

If the pass counter is programmed to a figure greater than 1, the figure at the left hand side is counting up to this programmed figure at every recognized trigger condition at this level. So the user also gets the information where a loop is cancelled.

For example: The user expects at level 3 a programmed triggerword 121 times (pass counter is programmed to 121) but the system under test only runs 117 times to this triggerword.

Now the analyzer never can finish the trigger trace because the condition 121 is not true. By calling the monitor the user then gets the right value (117) at the left hand side of the level 3.

The user can stop the data recording manual by pressing the STP key.

This information about the actual status of trace a trigger could be time by time more important as the analyzing of the recorded data.

If the analyzer has finished the recording by himself, or if the user stops recording manual (STP key), the display is changing from the trigger and trace monitor back to the display from where the monitor was called earlier.

3.2.2 (continued)

One very interesting point more:
If the analyzer was stopped manually by the user, depending of a not completely executed trigger-sequence, this last trigger status is fixed internally in the analyzer and shown later by calling the trigger menu for reprogramming the trigger conditions. So the user can remember the point of last triggerexecution and set up a new trigger depending on this condition of last recording.

This trigger status is only fixed between two data recordings.

3.3 OPERATIONAL DETAILS ON THE STOP TRACE FUNCTION

There are a few situations where the logic analyzer can't stop recording by itself because there are **only a few clock pulses** or there is **no trigger available.**

To analyze the logic analyzers memory after an abort it is important to know what is going on in the hardware during the stop process:

1) When the STOP key is pressed the logic analyzer automatically switches over to the free run mode. If there are clocks available the logic analyzer will have the chance to complete the trace.

2) If after a second the analyzer could not sample enough posttrigger data the memory will be filled with logic ones, using a 20 MHz internal clock.

3.3 (continued)

The burst of sampled data may sit anywhere in the memory - depending on the situation when you stop. But if you expect that you will have only a limited number of clock pulses - and this is your reason to abort the trace - then you will have a defined situation.

We would recommend the following procedure:

1. Disconnect all input probes
2. Start a trace with internal clock, 50 ns, free run trigger
3. Reconnect the probes
4. Program your trace menu
5. Trigger conditions have to be: start/don't care, no additional trigger delay (3250: Min-Delay = 2)
6. Start trace
7. Press the STOP key when you are sure that your data will be in the memory
8. Then the logic analyzers memory has been filled as shown on next sheet.
   Notice that this typical pattern will occur after any abort. But the EOF location is shifting right the higher the sample rate will be.

After recording

- How to use the LAM 4850 A to analyse the data

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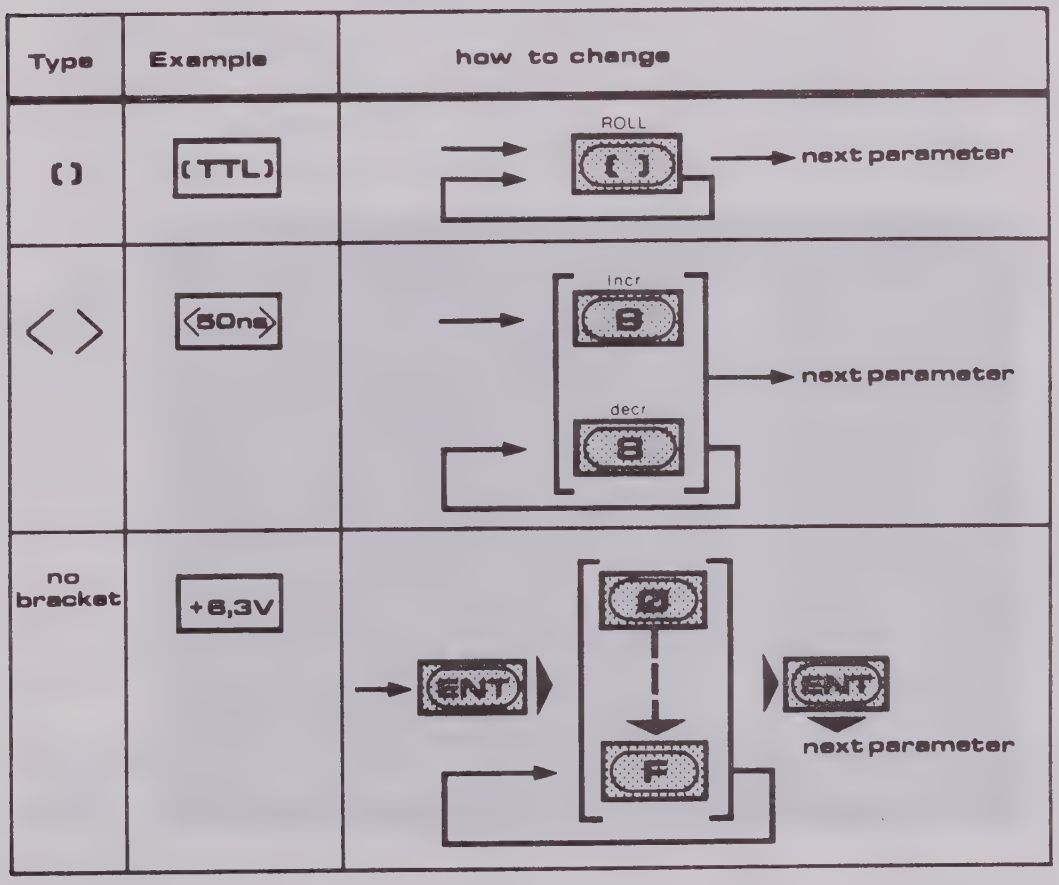
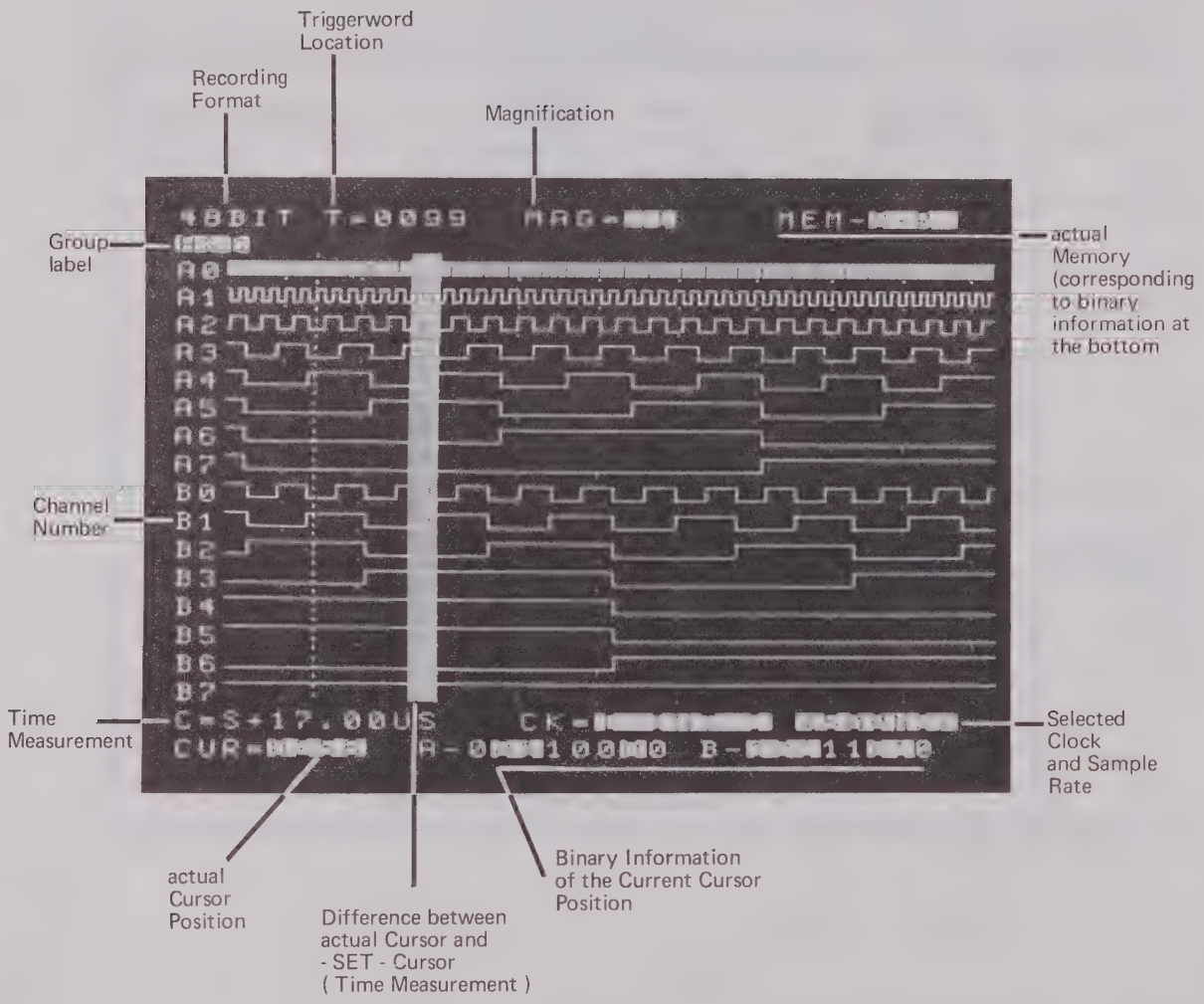
4.1. TIMING MODE

By pressing the **TMG/MAG** key of the **DISPLAY** group, the recorded data are presented as a **TIMING diagram** on the monitor of the logic analyzer, explained in detail in this section. Some parameters may be changed without calling the **TRACE MENU**, so remember the rules of programming parameters.



TIMING DIAGRAM



4.1.1 INFORMATION FIELD AROUND THE TIMING DIAGRAM

In the upper left corner of the monitor the recording format of the present data (32 bit 2K / 48 bit 1K) is indicated.

- if the user changes from, for example, 32 bit mode to 48 bit mode in **TRACE MENU** and then calls back the **TIMING diagram** before starting the analyzer, this information does not change to the new recording format. This is because the present data are recorded in a 32 bit mode and also shown in this mode on the monitor.

  After the first recording, this information will change to the new format (48 bit).

The next field to the right **T=nnnn** gives information about the triggerword position in the memory. If the triggerword is outside of the memory or the recording was cancelled by pressing the **STP** key, an **XXXX** is presented in this field. The same position is marked with a vertical dotted line in the timing diagram (if within the memory).

At the next field in the same line the factor of expansion is shown. (By first calling the timing diagram always X1).

In the upper right corner of the monitor there is shown the actual **MEMORY** representation. The selected function depends on the two binary fields in the last line of the monitor. These two fields represent the data at the actual cursor position in a binary format.

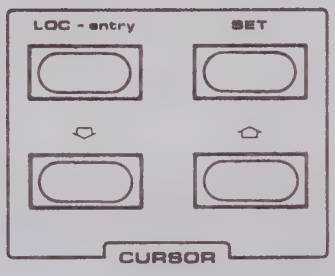
The handling of the display memory is described in detail in section **MEMORY CONTROL.**

NOW WE SHALL CONSIDER

HOW TO USE THE TIMING DIAGRAM FOR DATA ANALYZING

4.1.2 MOVING THE CURSOR

To move the cursor (forwards/backwards) on the monitor the keys of the **CURSOR** group are used



There are two ways to move the cursor:

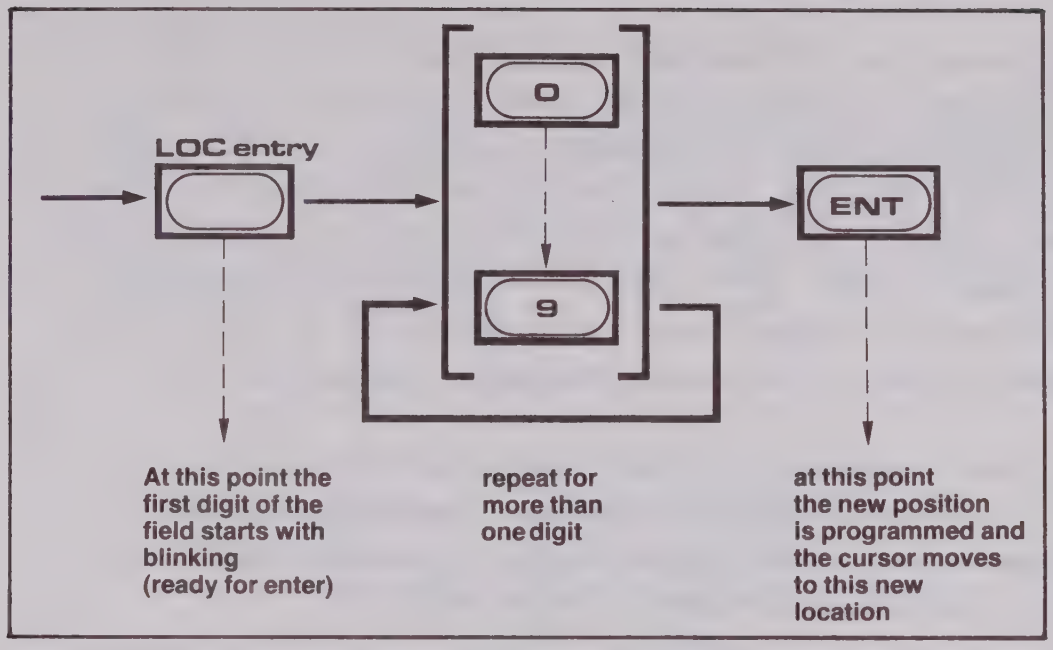
1) Step by step forwards/backwards by pressing the keys.

The cursor will move as long as the user presses down one of the keys.

2) Direct entry the number of the cursor position.

At the last line in the left corner of the monitor is a field showing the actual cursor position.

To program any numerical cursor position, enter the desired number in the following way:

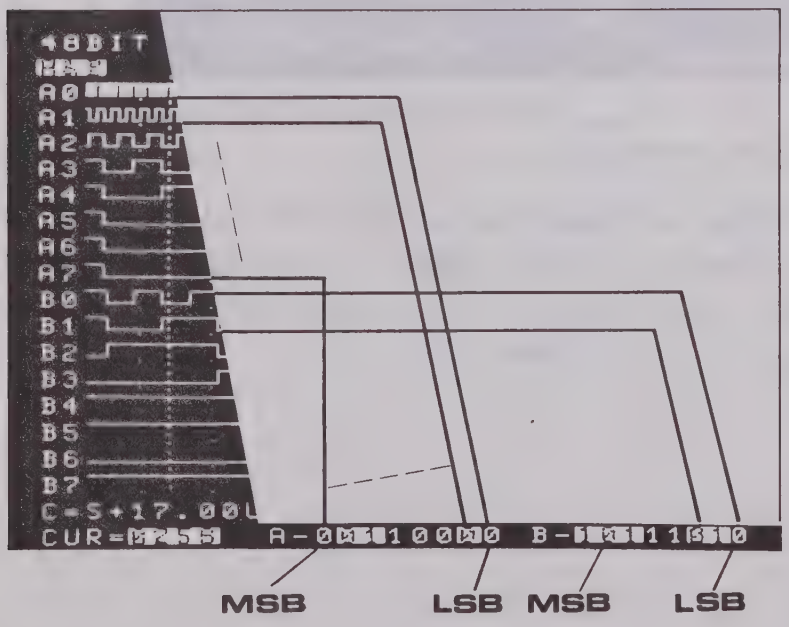


Both **DISPLAY** cursor control keys (**EDIT** group) can be used to skip positions of the digits.

The actual binary value at the current cursor position is shown in the last line at the bottom of the monitor.

The assignment is done in this way:

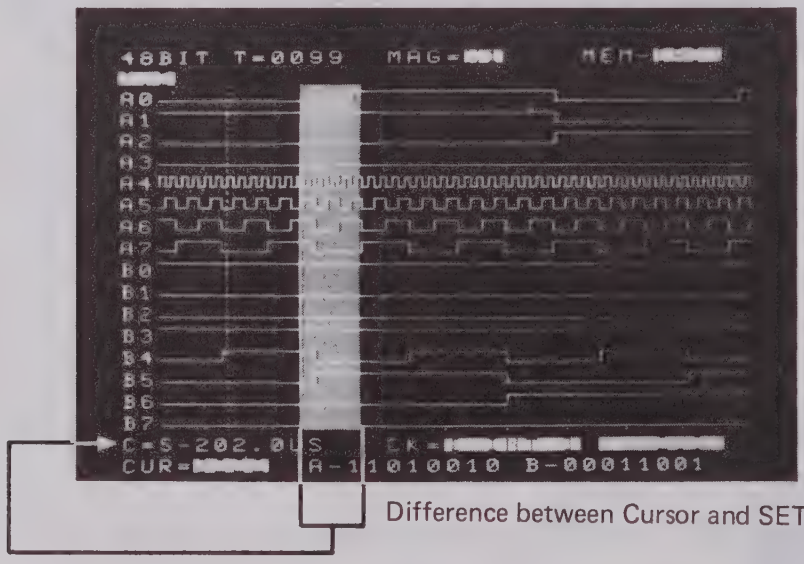
e.g. POD group A+B



4.1.3 TIME MEASUREMENT

Additional to the "normal" cursor the user can define a **SET POINT** at every current cursor position by pressing the SET key. At this moment cursor and set point have the same position. If the cursor is now moved in either directionbilities, the set point is fixed to its position by pressing the SET key. The difference between set point and new cursor position is presented as a half tone inverse video field across the whole timing diagram.

But more important: At the left corner in the last line but one, the difference of the points **(SET/CURSOR)** is presented as a time value depending on the sample clock of the recording: **CUR/SET = 20.05 ns.**

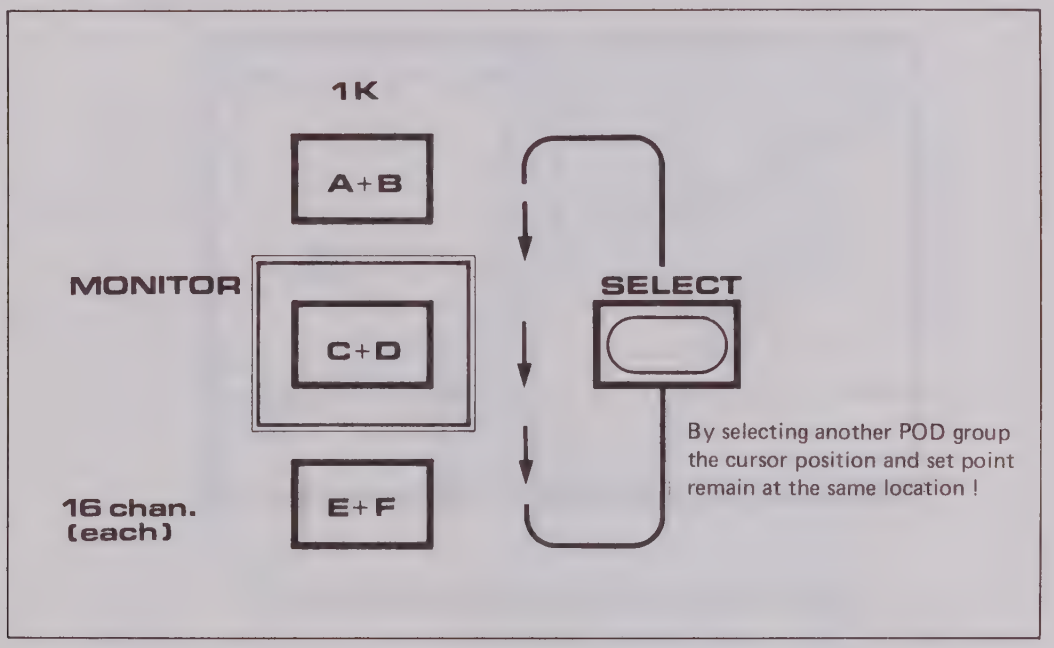


Difference between Cursor and SET Point

If the recording was taken by an external clock, the difference is presented as the number of samples (memory locations). The time (sample) measurement works in both directions from the fixed **SET** point.

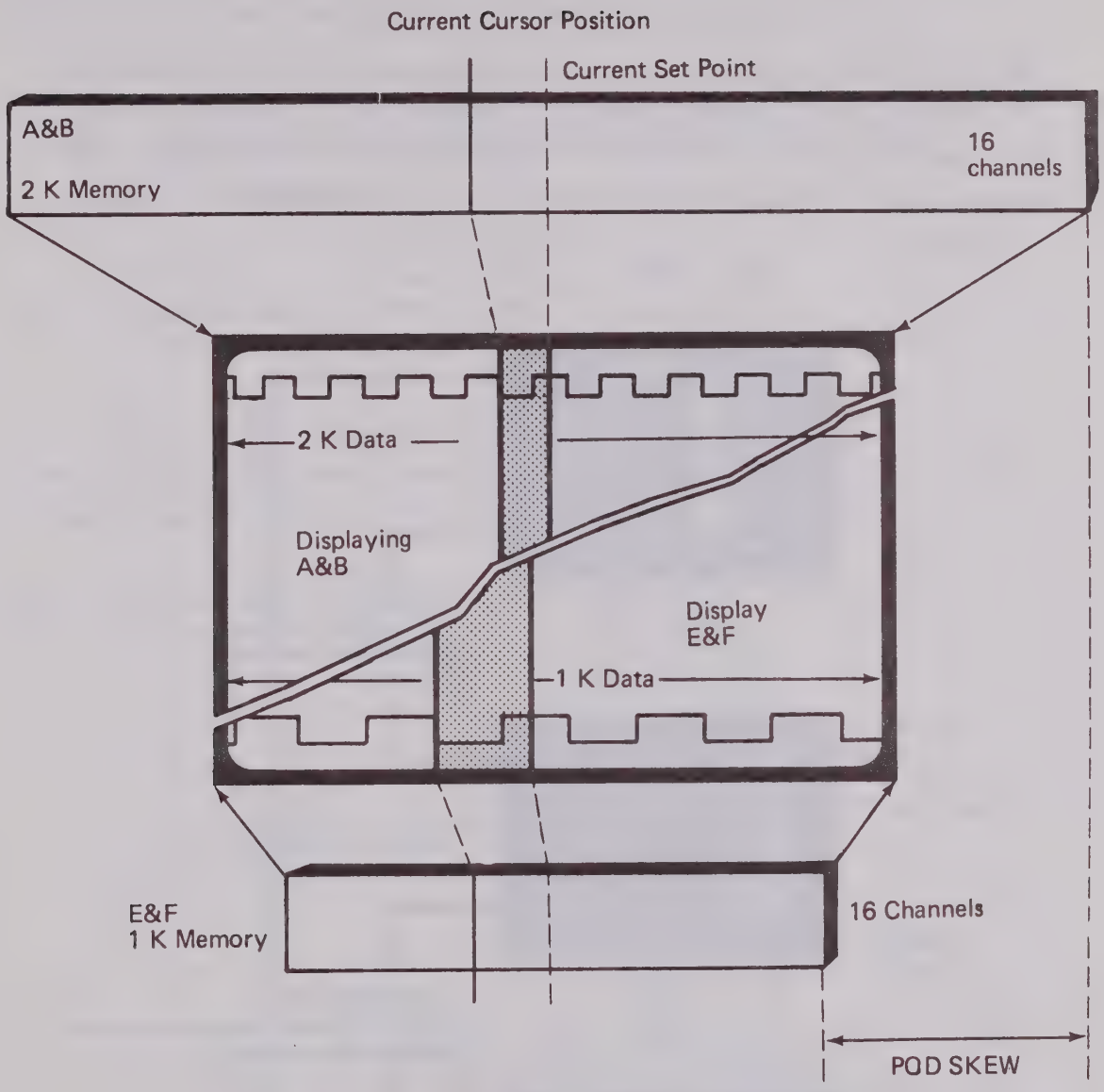
4.1.4 POD GROUP SELECTION 1K (48 bit mode)

One **POD** group at a time is shown on the monitor (16 bit e.g. A+B). For presenting the other active **POD** groups (e.g. C+D or E+F) it is necessary to press the key of the **DISPLAY** group. Pressing again this key, the next active **POD** group is shown etc.



POD groups set to **OFF (TRACE MENU)** are skipped. This is true for the **1K** format (48 bit).

If the **2K** format (32 bit) is programmed, it has another appearance.

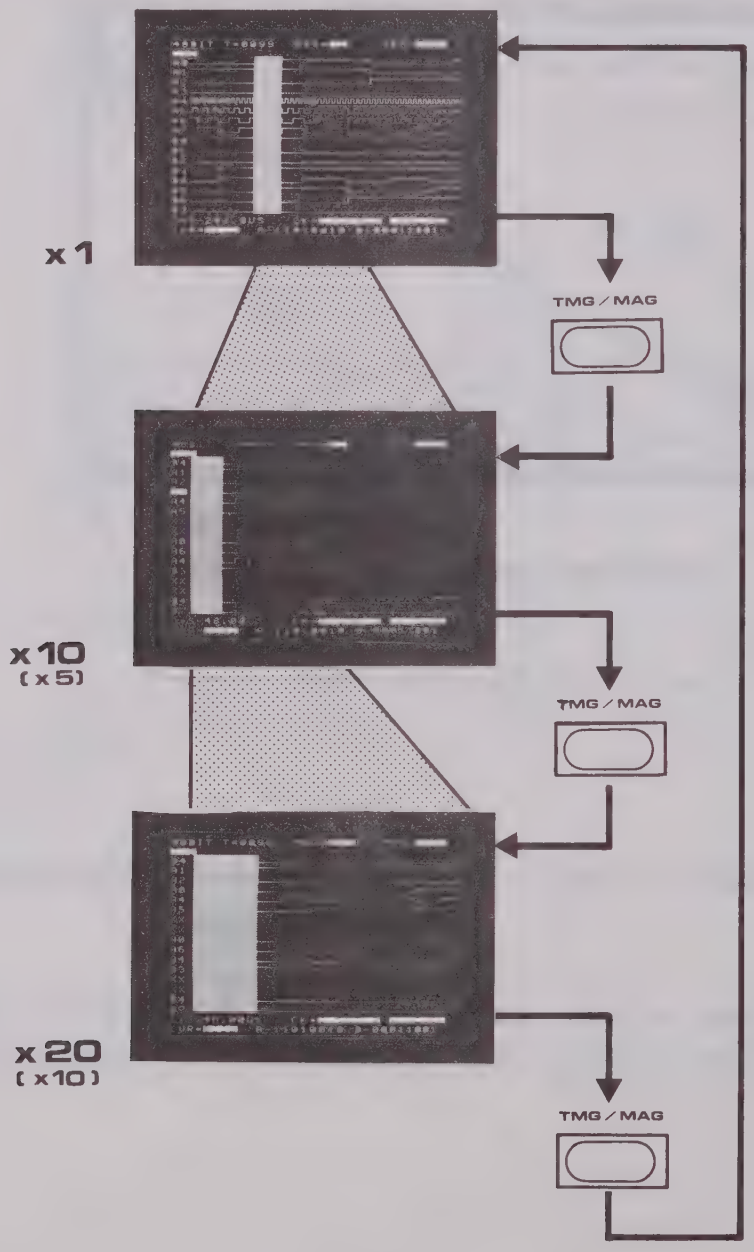


The same effect is true for the difference of **SET/CURSOR** position.

And if the same signal is recorded at A+B and E+F: at E+F it looks magnified, but the presentation is exactly correct.

4.1.6 EXPAND THE TIMING DIAGRAM

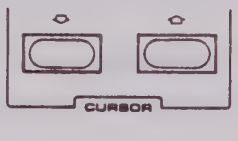
To see more details of the recorded data it is possible to expand the present data by factors of 10 and 20 in 48 bit mode and by factors of 5 and 10 in 32 bit mode. The expansion is executed when pressing the **TMG/MAG** key again and again.



Each time the expansion is shown from the current cursor position up to the right hand edge of the monitor.

In X1 mode, the cursor can be moved to the left or to the right by pressing the appropriate cursor control key.

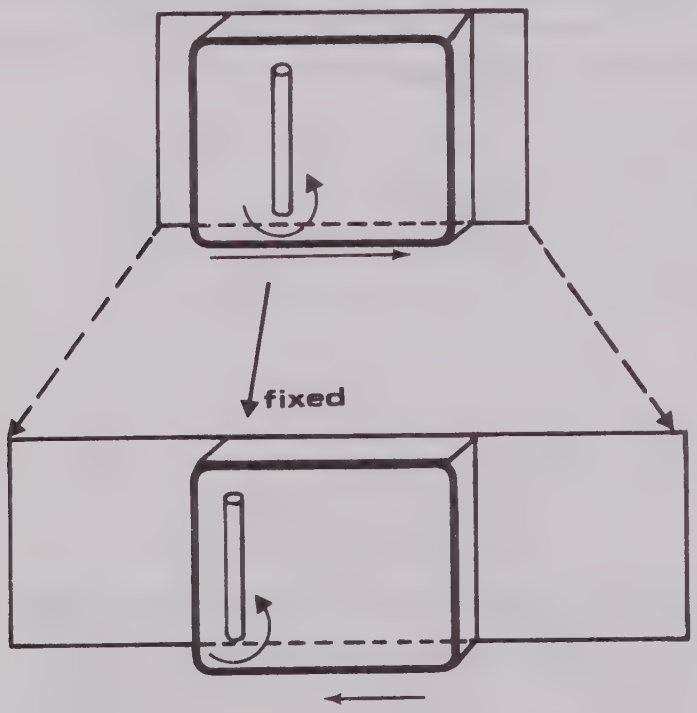
left key:
cursor moves to the left



right key:
cursor moves to the right

In expand mode the cursor is **fixed** at the left side of the monitor and now, when pressing the left key, the **timing diagram** moves to the right side.

The next figure illustrates this:



(the information is "fixed")

cursor is moving

expand (the cursor is fixed, the information is moving)

The cursor looks like "a cylinder rolling over the screen" (X1) e.g. to the right. If the cursor (cylinder) is fixed and turns the same direction, the expanded data appear to scroll.

4.1.7 CHANNEL ARRANGEMENT

Sometimes it is helpful to see the timing information in a different way than is normally presented on the monitor, e.g. channel A3 and then in the next line channel B5 instead of A4, or to switch one or more channels off. This logic analyzer has such a facility.

Before a channel re-arrangement can be done, the correct **POD** group must be selected: A+B or C+D or E+F (the **POD** group must be active).

The start key for the special arrangement is

in the edit group.

Now the first channel labeled at the upper left corner (e.g. AØ) is set in inverse video and starts blinking to indicate its ready for reprogramming.

4.1.7 (continued)

There are three different ways of reprogramming:

1) Delete the channel by pressing the [OFF X] key. Deleted channels are presented by XX in the label field.

2) Change the channel number by entering the channel group (e.g. A or B) and the channel number by entering the digit (0 ⟶ 7). It is possible to enter the number only if the group is currently displayed.

3) Move the cursor up and down to select a channel before programming, by using the [▽] [△] keys. Then the blinking field indicates where the cursor is located.

When the complete reprogramming is finished, the [HOME] key must be pressed again to terminate the action.

4.1.7 (continued)

If the cursor is currently at the label of the first channel (eg. AØ), then when the

key, is pressed the field will stop blinking and the action is terminated.

If the cursor is currently at another label, by pressing the

key, the cursor will move to the label of the first channel (e.g. A0) and then the

key must be pressed again to finish the action.

All three possibilities can be used in any combination. It is also possible to reprogram a deleted channel.

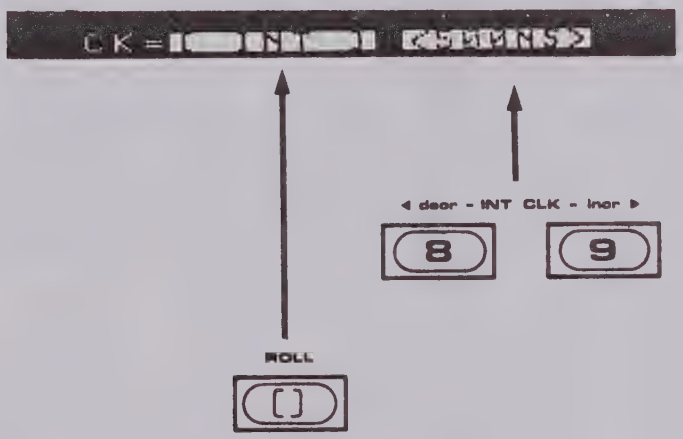
4.1.8 REPROGRAMMING THE TRACE PARAMETER

In timing mode it is possible to change two **TRACE** parameters normally programmed in the **TRACE MENU.**

1) The internal sample rate clock
2) The clock source for recording

The change can be accomplished without calling the **TRACE MENU.**

In the monitor in the second from last line on the right are two fields.



If either of these parameters is changed the corresponding field starts blinking to indicate that the present data were recorded with another **TRACE** parameter. By starting the analyzer after changing the parameter, a recording is made with the new parameter. When the new recording results are displayed on the monitor, the field stops blinking, because the present data were collected under the conditions shown.

4.2 LIST MODE

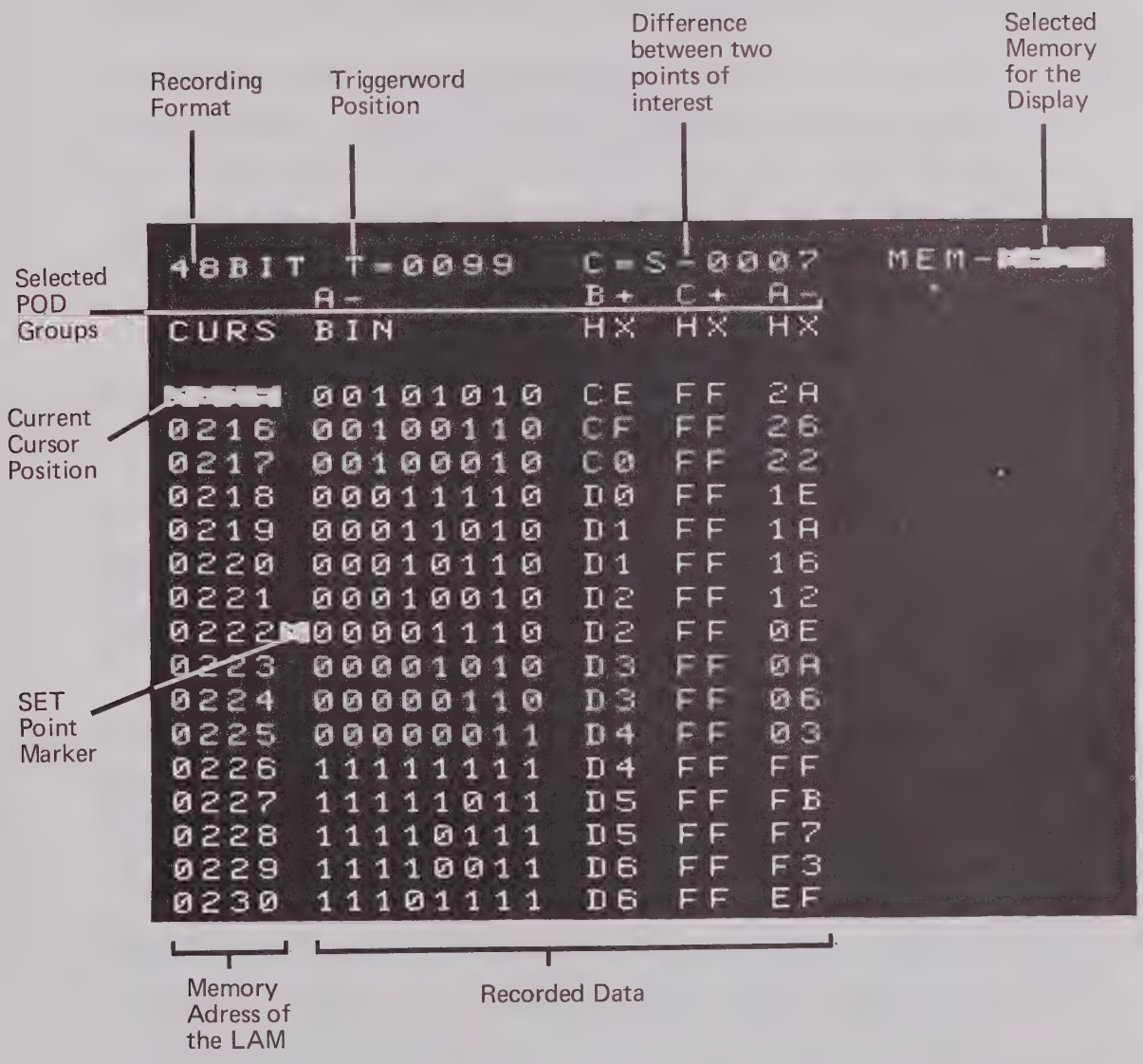
When pressing the

key of the **DISPLAY** group, the recorded data is displayed as a list of **HEX, BINARY, OCT** etc. data on the monitor.

All information the user can extract from the **LIST** diagram and how to work with the analyzer in **LIST** mode are described in detail in this section.

General

The leftmost column on the monitor gives the memory **location** of the analyzer's data.
Subsequent columns to the right give the data at each memory location, corresponding to the respective POD groups which are entered at the top of the display.


Recording Format
Triggerword Position
Difference between two points of interest
Selected Memory for the Display
48BIT T-0099 C-S-0007 MEM-
A- B+ C+ A-
CURS BIN HX HX HX
00101010 CE FF 2A
0216 00100110 CF FF 26
0217 00100010 C0 FF 22
0218 00011110 D0 FF 1E
0219 00011010 D1 FF 1A
0220 00010110 D1 FF 16
0221 00010010 D2 FF 12
0222 00001110 D2 FF 0E
0223 00001010 D3 FF 0A
0224 00000110 D3 FF 06
0225 00000011 D4 FF 03
0226 11111111 D4 FF FF
0227 11111011 D5 FF FB
0228 11110111 D5 FF F7
0229 11110011 D6 FF F3
0230 11101111 D6 FF EF
Selected POD Groups
Current Cursor Position
SET Point Marker
Memory Adress of the LAM
Recorded Data

4.2.1 INFORMATION AT THE TOP OF THE MONITOR

At the upper left corner of the monitor the recording format of the present data (32 bit 2K / 48 bit 1K) is indicated.

- if the user changes from e.g. 32 bit mode to 48 bit mode in **TRACE MENU** and then calls back the **LIST** mode before starting the analyzer, this information does not change to the new recording format. This is because the present data are recorded in a 32 bit mode and also shown on the monitor.

  After the next recording this information will change to the new format (48 bit).

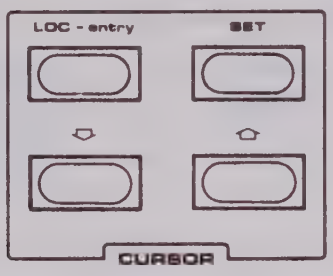
The next field **T=nnnn** gives information about the triggerword position in the memory. If the triggerword is outside of the memory or the recording was cancelled by pressing the **STP** key an **XXXX** is presented in this field.

The same position is marked at the memory location information (leftmost column on the monitor) by displaying the word **TRIG** instead of the memory address. The word is displayed in inverse video.

The next two fields are described later in this section.

4.2.2 MOVING THE CURSOR

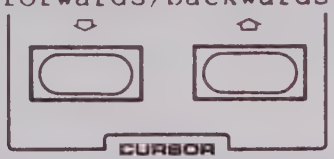
To move the cursor (forwards/backwards) on the monitor, the keys of the **CURSOR** group are to be used



NOTE: The current cursor position is always the first line of information on the monitor.

There are two ways to move the cursor:

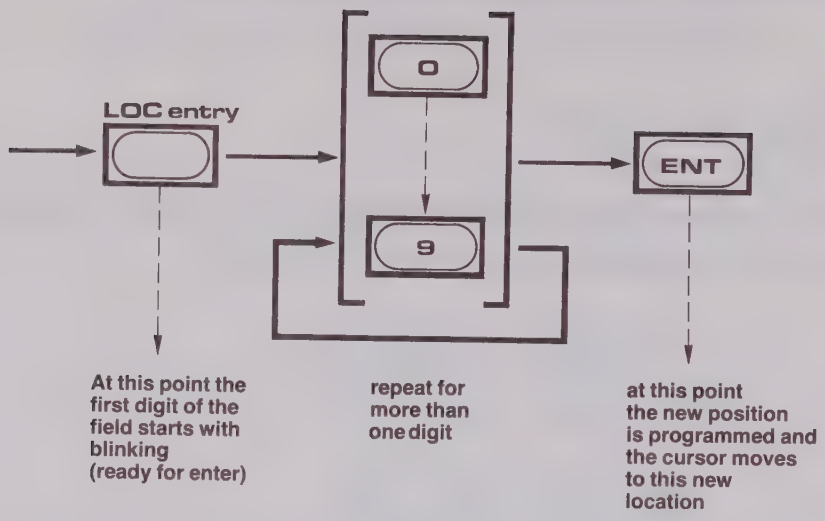
1) Step by step forwards/backwards by pressing the keys.



The information will scroll as long as the user holds down one of the keys.

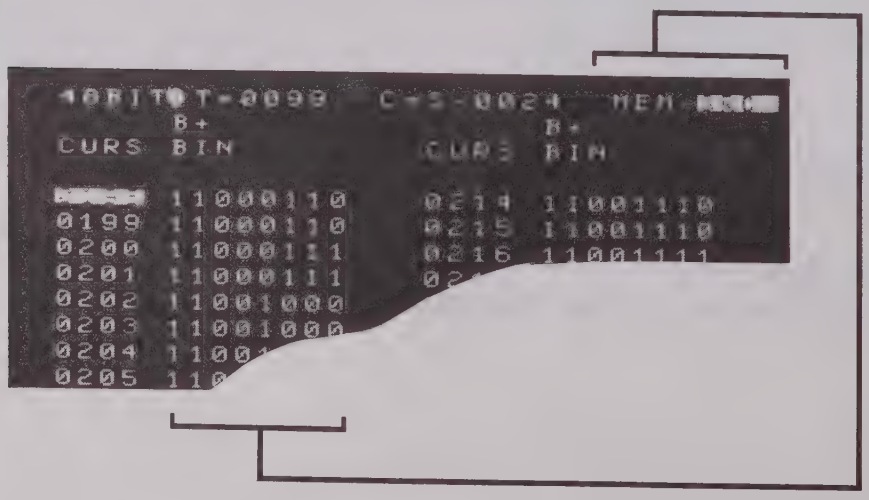
2) Direct entry: the number of the cursor position.

To program the next position, enter the desired numerical value in the following way:



Both **DISPLAY** cursor control keys (**EDIT** group) can be used to skip digit positions.

If the number of selected channels and the way in which they are displayed (**BINARY, HEX etc.**) is smaller than half a screenwidth, the information starts at the upper left position (**CURSOR** position) and continues on the right side of the monitor in the same notation. So, by moving the cursor, the corresponding data changes in both parts of the monitor.



4.2.3 SAMPLE MEASUREMENT

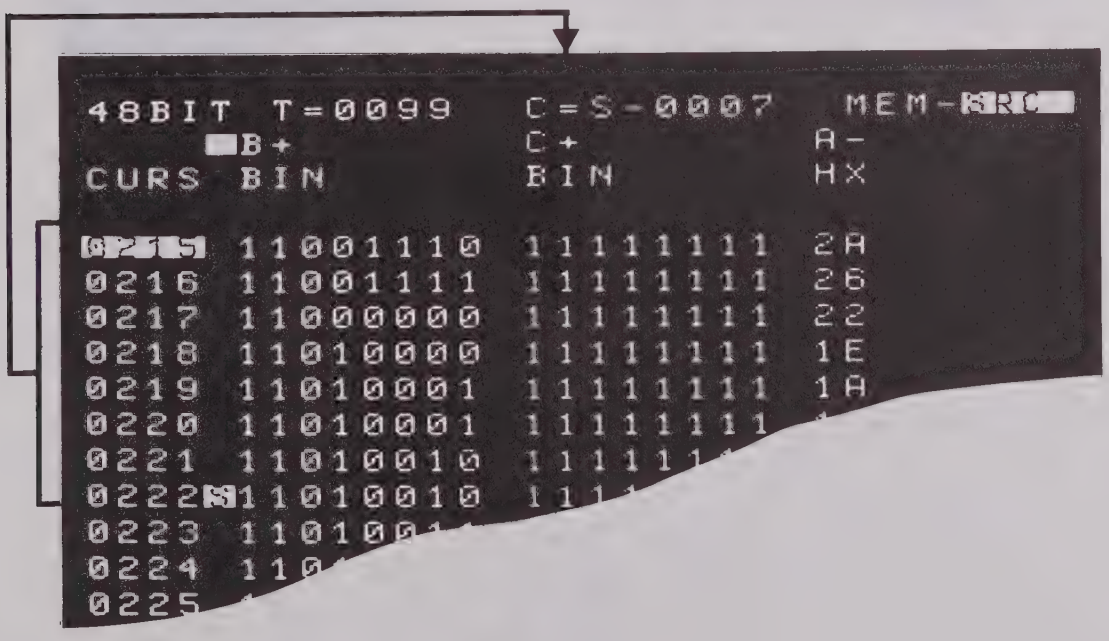
In addition to the "normal" cursor the user can define a **SET POINT** at any current cursor position by pressing the key.

At this moment, cursor and set point are at the same position. If the the cursor is now moved (in either direction), the set point is fixed at its position by pressing the key. The distance between the set point and new cursor position is indicated in the third field of the topline

C = S ± nnnn

where **nnnn** is the positive or negative distance moved, by the cursor relative to the set point, measured as a number of memory locations.

The actual **SET** point is marked with an **S** at the appropriate memory location.



4.2.4 POD GROUP SELECTION

Each active **POD** group can be displayed in whichever notation the user desires:

BINARY, HEXADECIMAL, OCTAL or **ASCII.**

There are no restrictions on programming the various bases. It is possible to select different notations for the same **POD** at one time. The polarity of the present data is also selectable **POS.-** or **NEG. Logic.**

This data formatting only affects the monitor display; the data in memory are not altered.

The number base may be rearranged in two ways:

1) By reprogramming the data displayed on the monitor. (4.2.4.1)

2) By programming a **POD** group which was not previously dislayed, or additionally programming an existing **POD** group (4.2.4.2).

4.2.4.1 Reprogramming displayed data

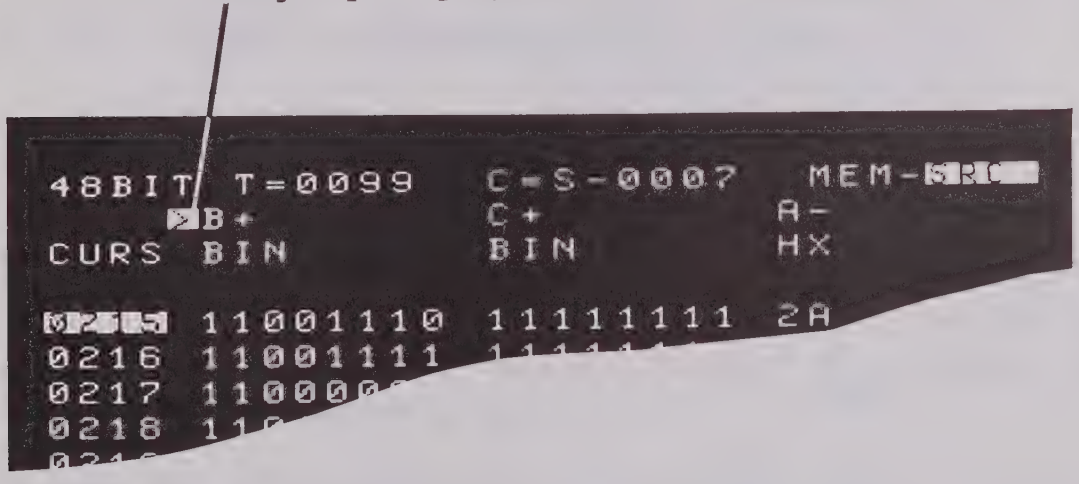
In a **POD** group on the monitor, it is possible to change the data displayed

a) to another polarity (e.g. **POS ▶ NEG**)
b) to another base (e.g. **HEX ▶ OCT**)
c) to another **POD** group (e.g. **A ▶ E**)

In order to do this, the HOME key must be pressed first.

Now, by the first column of data, a small arrow in inverse video starts blinking in front of the label.

Now this **POD** group is prepared for reprogramming

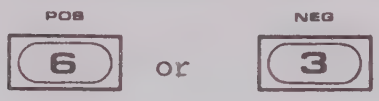


To select another existing **POD** group for reprogramming, the ◁ ▷ keys can be used to move the blinking arrow field to any other **POD** group.

4.2.4.1 (continued)

If the **POD** groups to be changed are selected in this way, the change to another presentation can be done very simply:

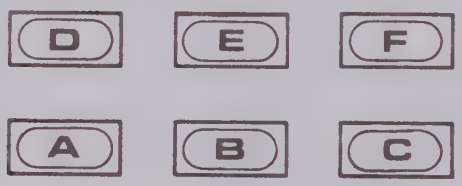
a) change to another polarity by pressing the



key.

After pressing one of these keys, the data in this **POD** group are now presented in the selected format.

b) Change to another **POD** group by pressing one of the



keys.

After pressing one of these keys, the data of this column are changed to the selected **POD** group, including the label. If the **POD** groups for reprogramming are not active (e.g. C+D in 2k mode) or set to **OFF**, the analyzer sends a flashing message to the top of the monitor: **INVALID ENTRY** only for the user's information. Nothing is changed or destroyed.

c) Change to another number base by pressing one of the

keys.

After pressing one of these keys the data in the selected column (blinking arrow) are displayed in the reprogrammed number base.

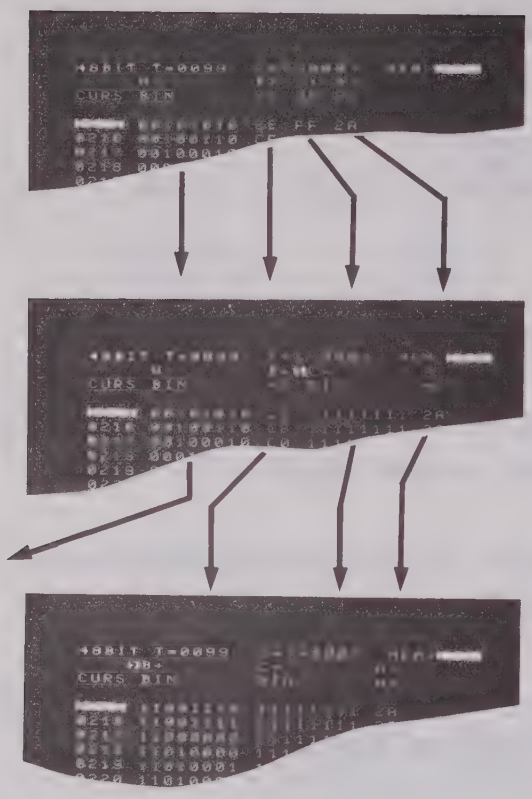
NOTE: The limit of the shown **POD** groups is the size of the monitor.

Of course, not all **POD** groups can be presented in binary at one time on the monitor.

If now the base is changed from **HEX** (2 positions) to **BINARY** (8 positions), we could run out of space on the monitor. But the reprogramming has the highest priority.

So the analyzer peforms a right-shift of the displayed data, if there is enough space on the right. If there is no more space on the right the analyzer performs a left-shift, whereby the first (leftmost) column may disappear.

The direction of shift starts at the selected column of presented data (blinking arrow).



reprogramming
POD C binary

then POD B binary
(A binary is removed)

All reprogramming commands are terminated by pressing the HOME key again (the arrow will then disappear) except in one case: Cancel the selected group by pressing the DEL key.

In this way, the selected column and the arrow disappear at the same time. The data columns to the right of the cancelled column are then shifted to the left, to gain more space at the right.

Another point: If only, for example, two **POD** groups are present in **HEX**, the list continues into right-hand half of the screen. The user can only select channels with the arrow in the **left-hand** data heading.

4.2.4.2 NEW PROGRAMMING

New programming of a POD group not previously displayed, or additional programming of an existing POD group

To present **POD** groups not previously displayed, or to present an existing **POD** group additionally in another way, the user has to enter three parameters:

a) The **POD** group (e.g. **D**)
b) The base (e.g. **BINARY**)
c) The polarity (e.g. **POS**)

To start with a new programming the analyzer needs only one of these three parameters (e.g. **POS**)

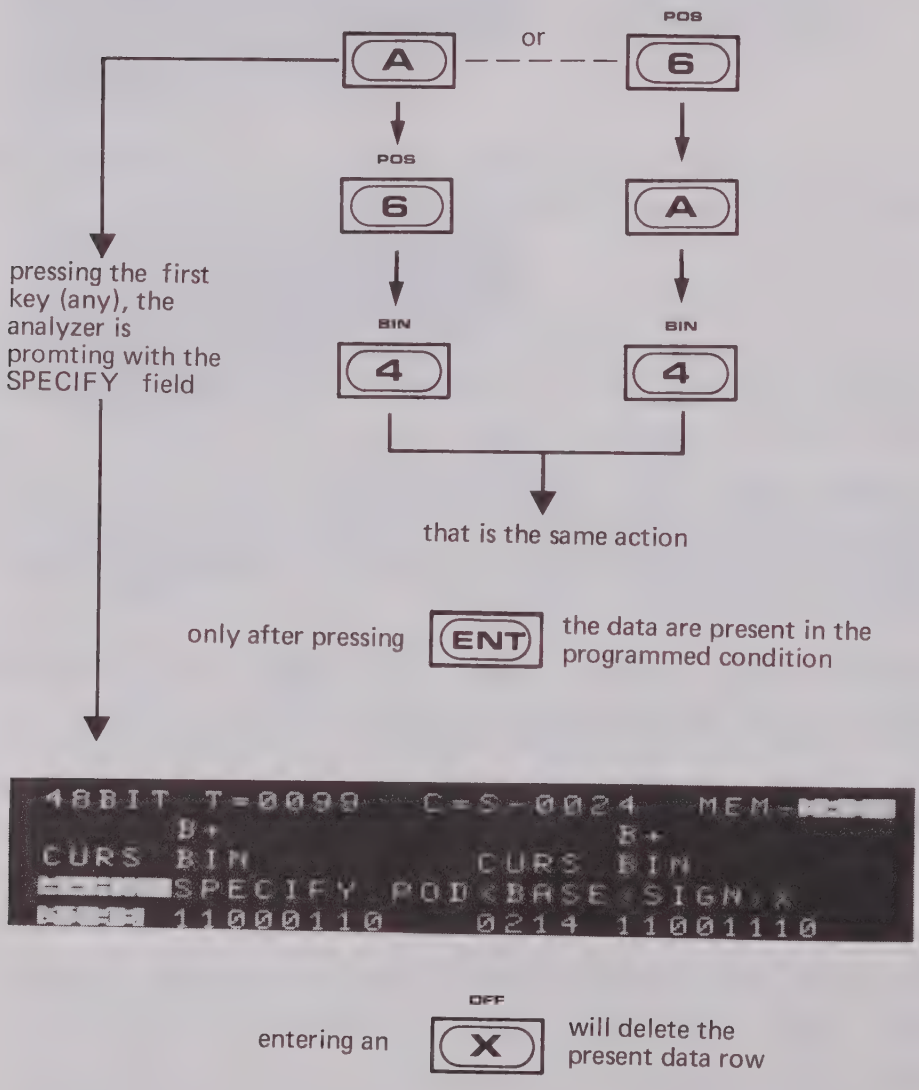
Then, by pressing one of the keys (e.g. POS [6]) the analyzer presents an inverse video field over the first data (cursor line) with the notation of the pressed key (e.g. [+] for **POS**). There is a further message in the same line to inform the user which parameters to enter [+] **SPECIFY: POD BASE SIGN, X.**

So the user has to enter the remaining parameters (e.g. **A** and **BIN**), which he may do in any order.

4.2.4.2 (continued)

The user can change the parameters already programmed and presented in this inverse video field as often as required. Only the pressing of the **ENT** key terminates the entry and then the data will be displayed immediately in the selected format.

For example:



In this way only the **POD** group and **OFF** need to be entered (the first key must specify the **POD** group).

If there are more than one column representing data of a POD group (e.g. A in **HEX** and A in **BINARY**) and then pressing **A** and [OFF X] will cancel all display columns of POD group A

(**A** and **A**)
(**HEX** **BINARY**)

independent of the position of the columns.

By switching **OFF** a **POD** group, all data are shifted to the left (next free position from **OFF**).

When an additonal POD group is selected, the new column of data is inserted on the display to the right of existing data lists.

If there is not enough space on the monitor, the first one (or two) columns at the left will now disappear because the new programming has the highest priority. But the columns which are about to disappear are shown during programming by blinking of the relevant labels.

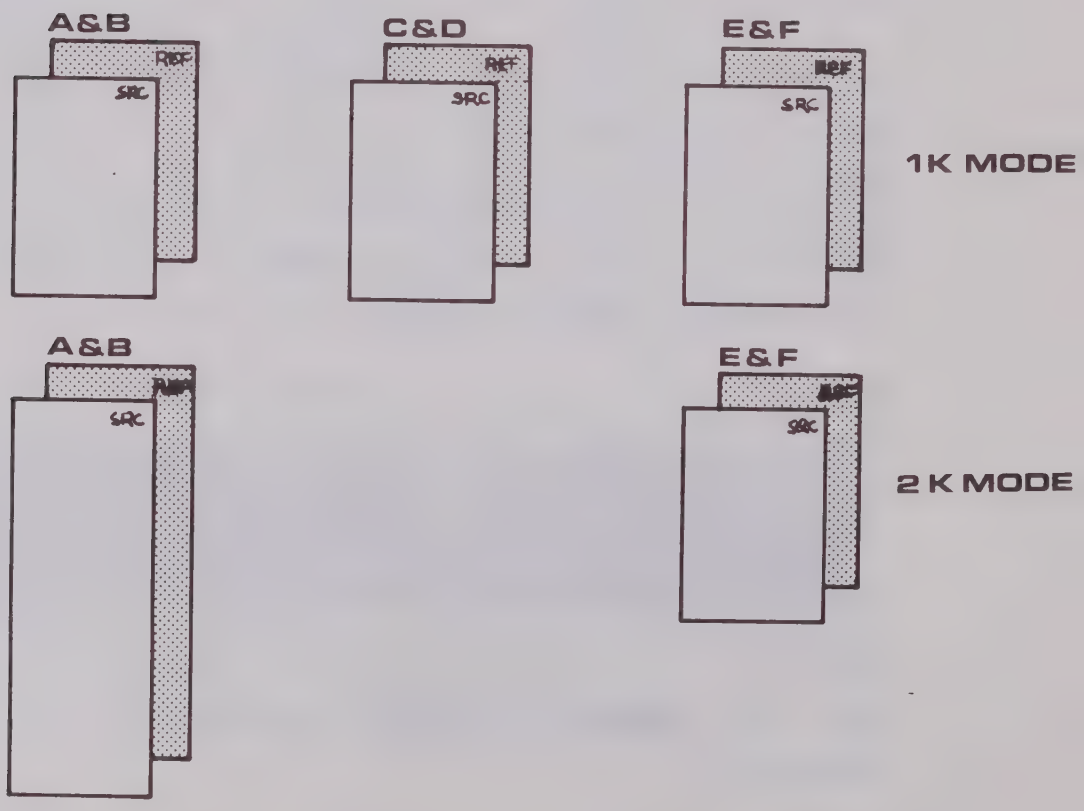
So the user is given the information as to which list will be cancelled, as a result of the new selection, before the [ENT] key is pressed.

If the user wishes to prevent a column of data from being deleted in this way, he should press **LIST/SPECIFY** key in the display group. Any new which has not yet been **ENTERED,** POD specification, will be thus cancelled.

4.3 MEMORY CONTROL

The basically memory organisation in the 4850A is 48 bit (channels) wide and 1000 locations deep (1K mode). All recorded data during a measurement are loaded in this memory after the recording is finished. This memory is called the SOURCE memory. Additional in the 4850A a second memory is installedwith the same size (48 bit, 1000 words). This second memory is called the REFERENCE memory.

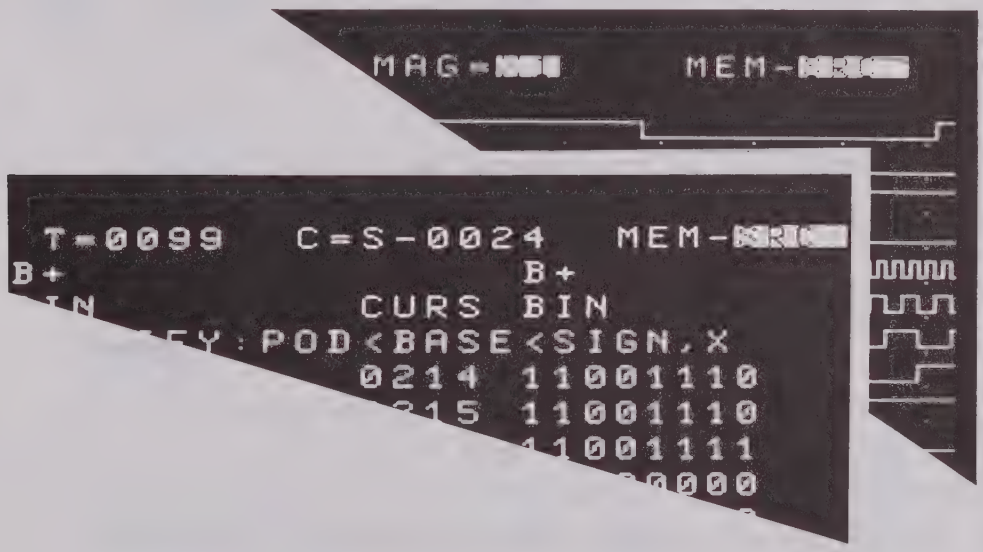
This reference memory is always organized like the source memory. It means if the user selects the 2K Mode (16 bit 2000 words and 16 bit 1000 words) the reference memory becomes the same structure by transfering the data from **SOURCE** to **REFERENCE.**



With these two memories the user gets a wide range of possibilities to analyze data from an old recording depending on data from a new recording explained now in detail.

4.3.1. SELECTING OF DIFFERENT MEMORY FUNCTIONS

In timing and list mode at the headline, the last field at the right is representing the actual display of memory contents.

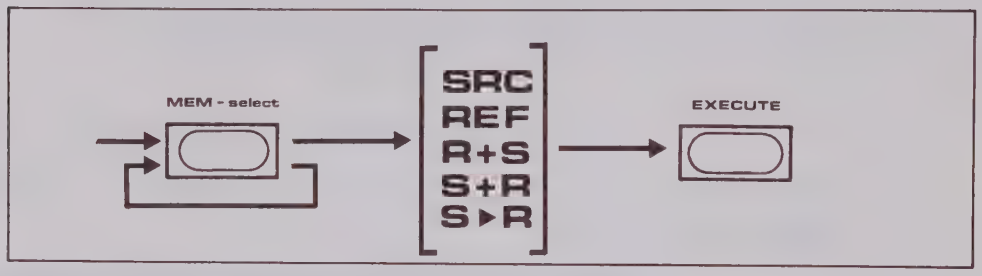


In List mode this field is depending on the whole data shown on the display, in Timing mode this field means the way how the two binary fields at the buttom of the display are shown. The timing by himself only shows data from the source memory at every time.

By pressing the MEM-select key of the specify group the user can select different functions of displaying the data.

4.3.1 (continued)

The function of this key is like the menu key. Every pressing of this key selects another function. To call the selected function, the user has to press **EXECUTE.**



4.3.2. THE DIFFERENT FUNCTIONS

- SRC

The data of the Source memory are shown on the display.

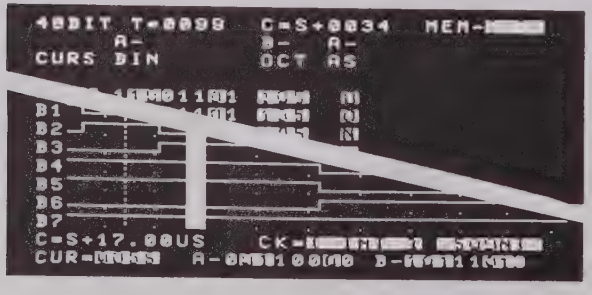
- REF

The data of the Reference memory are shown on the display.

- R + S

The data of the Reference memory are shown on the display but with an EXCLUSIVE OR of every location to the Source memory.

If there is a difference of data at the same memory location this position is signing by highliting with an inverse video field.



in LIST mode

in TIMING mode

4.3.2 (continued)

This inverse video field is drawing depending on the selectet base of the present data.

EXAMPLE:
Reference memory = 10101110 = AE (Hex) 256
Source memory = 11101110 = EE (Hex) 356

By selecting [R+S] the data are shown in the following way by different base:

HEX	BIN	OCT
[A]E	1[0]101110	[2]56

This needs no more explanation

- [S + R]
  It is the same like R + S but now the data of the source memory are shown on the screen with EX OR to reference memory.

- [S→R]
  By pressing the EXECUTIVE key the analyzer transfers the data from the source memory to the reference memory and no change to the actual display function is done. In this moment the reference memory becomes the same structure and organization like the source memory. This is very important to know for automatic compare.

During pressing the MEM select key, the field in the upper right corner starts with blinking to show that the displayed data are not the data now displayed at this field. Only if the EXECUTE is done and the now selected data are present on the screen, this field stops with blinking, or the user steps back (while pressing the key) to the function are equal to the present data.

4.3.2 (continued)

All normal functions of the two different display modes (timing and list) are completelly available without any restriction at every selected function of the memory.

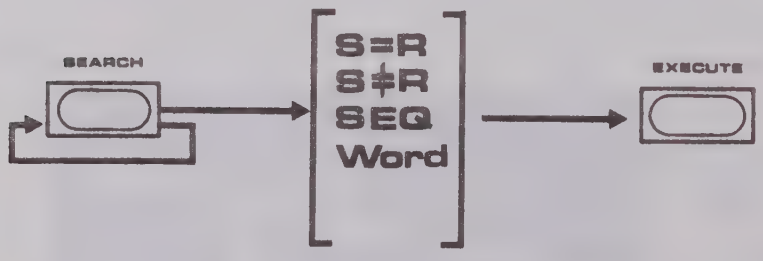
4.4 SEARCH CAPABILITY

A very powerfull tool after a data recording are the different search functions of the LAM 4850A. These search functions are selectable by pressing the SEARCH key of the SPECIFY group. At the first pressing of this key the memory control field (refer to chapter 4.3.1) at the right hand side in the headline in timing and list mode are changing to the search selecting mode
The actual memory select is fixed internally and not changed.

4.4.1 THE DIFFERENT SEARCH MODES

Like the MENUE key or the MEM select key, the SEARCH key has the same function. Pressing and pressing again selects the different search modes like in a circle.

To initiate a search depending on the selected function the user has to press the EXECUTE key.



4.4.2 FUNDAMENTALS ABOUT THE SEARCH FUNCTIONS

Now starts the detailed information about the different search modes. Only the function is explained. The way how to operate after finishing search is explained seperately after this section because it is basically the same for all search functions.

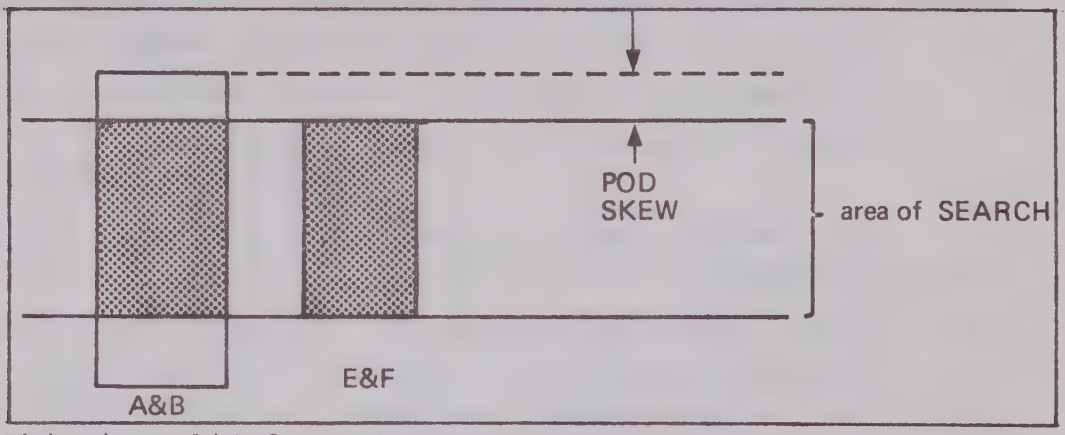
But before some very important notes about the search activity:
It is important to know that the selected search mode is only done for the displayed data not for the whole active pod groups. This means, at different arranging of the data at the LIST mode the user can get different numbers of events after executed search. The only search mode is looking to all active pod groups independing to the arrangement of the data at the display is the sequence search. In this search mode all active pod groups are tested for the programmed sequence.

One other difference is the search WORD function in timing mode at different channel arrangement. This special rule is described in chapter 4.4.2.3.2.

Another very important point makes the different memory organization (1k or 2k mode).

In 1k mode (48 channel 1k / A+B, C+D, E+F) the memory is tested from location 0 to 999 of the programmed search condition.

In 2k mode (16 channel 2k - A+B and 16 channel 1k - E+F) the search is only done for the whole pod group in the range of the 1k pod group E+F depending on the pod skew.



This is valid for all search functions.

If in 2k mode the pod group E+F is programmed to [OFF] (Trace menue) then the search is done from location 0 to 1999.

4.4.2.1 [S = R]

Independing to the current cursor position the analyzer is executing a search in the range of the search area (refer to chapter 4.4.2) with searching for data are equal in source and reference memory. The search is done location by location and at every position where this condition is true, the analyzer is counting this event.

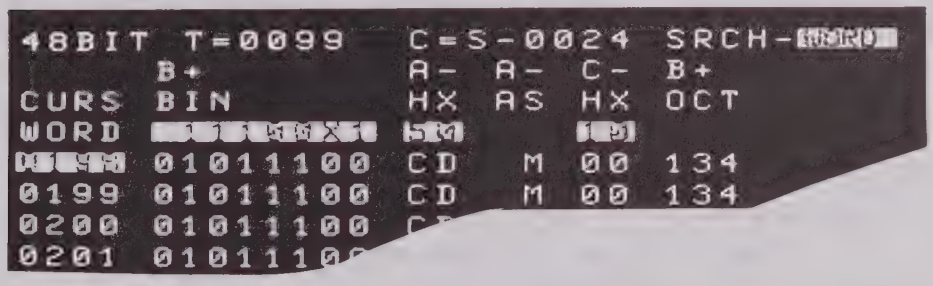
4.4.2.2 [S ≠ R]

Independing to the current cursor position the analyzer is executing a search in the range of the search area (refer to chapter 4.4.2) with searching for data are unequal in source and reference memory. The search is done location by location an at every position where this condition is true, the analyzer is counting this event.

4.4.2.3 WORD SEARCH

4.4.2.3.1 LIST MODE

At the same moment when this function is selected by pressing the SEARCH key an additional line is present on the display. This line is located between the label of displayed pod groups and the first data line (see figure) to program a word of interest. At the first call of this function after POWER ON this line contains XX (don't care).



The first most left field in this line is blinking to signing on: ready for programming.
Because this line depends on the selected base of the pods (e.g. BINARY, OCT or HEX) the user now can input a value representing the word for search. After programming one position the blinking field is changed to the next right position for next programming. By using the

and keys of the EDIT group

the user can skip a position or step back for reprogramming the word. Only at EXECUTE the word programmed and shown at this moment is taken for the search word function.
Now there are some points of important interest for the user.
In the list mode it could be that data from e.g. pod A are displayed more than one time (POD A+HEX and POD A+BIN).

If any pod group is displayed more than one time, the programming of the word for this pod is only possible at the first left position of this pod on the screen. At additional data of the same pod more right on the display, the line for programming the word is slapped automatically at this position.

So the user has to arrange the display in a way he likes to programm the word before selecting the search word function.

EXAMPLE:
The user likes to see the data of pod A in two ways: A + HEX and A + BIN.
Now if he likes to programm the word for search in BINARY he has to make sure that the row with A+BIN is the most left row of all rows of pod A.
Independing to the current cursor position the analyzer is executing a search in the range of the search area (refer to chapter 4.4.2). At every location where the word is found, a counter is incremented.

If at any time after power on a word is programmed for search and this search was executed, later on the search WORD function is called again. This last word is recalled automatically. This point makes it very simple to search for the same word after different recordings:

If there is no change to other search functions between the different recordings, the first pressing of the search key brings WORD function immediately.

Also this word is linked to the search word function in timing mode (4.4.2.3.2). It means a programmed word in list mode is automatically recalled at the same moment where this function (WORD) is selected later on in timing mode.

4.4.2.3.2 TIMING MODE

At the same moment when this function is selected by pressing the SEARCH key, the shown labels of the signals, e.g. A0 - B7 are completely replaced by a new row for programming a word of interest. At the first call of the search word function after power on this row contains X (don't care), (see figure)

The position at the top is blinking for signing: ready for programming.
Now the user can program a work in binary format by entering "1", "0" or X. After every input at one position the next location down is blinking for next programming. By pressing the

or keys of the edit group the user

can skip a position or step back (up) for reprogramming the word.
Only at execute the word programmed and shown at this moment is taken for the search word function.

4.4.2.3.2 (continued)

Now there are some points of important interest for the user.

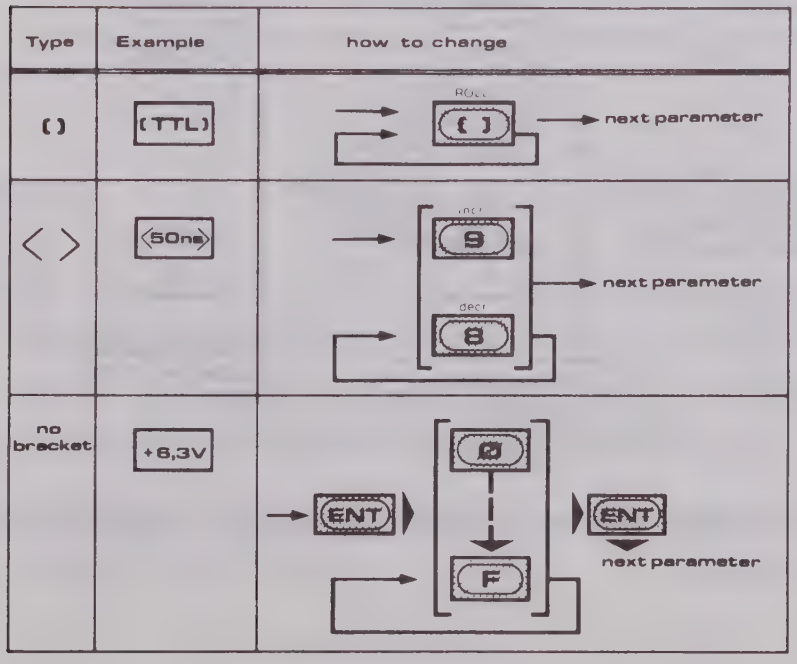
Remember chapter 4.1.7 (channel arrangement). It is possible to rearrange the channel of timing diagram in a really random way. This is very helpfull but it becomes some conflict with the search WORD function.

4.4.2.4 SEQUENCE SEARCH (SEQ)

The sequence search is like an extended word search. By selecting this search mode the user has the possibility to define 12 different, maximal 48 bit wide words as a sequence. That means this 12 words must be located anywhere in the memory and have to be in this sequence following immediately location by location like the user has programmed these words. The number 12 is the maximum. Any number between 1 and 12 is possible for defining a sequence. This 12 words are organized in two pages with 6 words each. To get these pages for programming the user has to select first the SEQ mode by pressing the search key till the upper right field shows "SEQ".

Then the user has to press the [ENT] (Enter) key of the edit group.

At this moment page 1 with the first six words is present at the display. Now before further information about the programming the sequence, please remember the basic rules for programming parameter for the LAM 4850A:



4.4.2.4 (continued)

Now at this point the user has two ways to program the sequence:

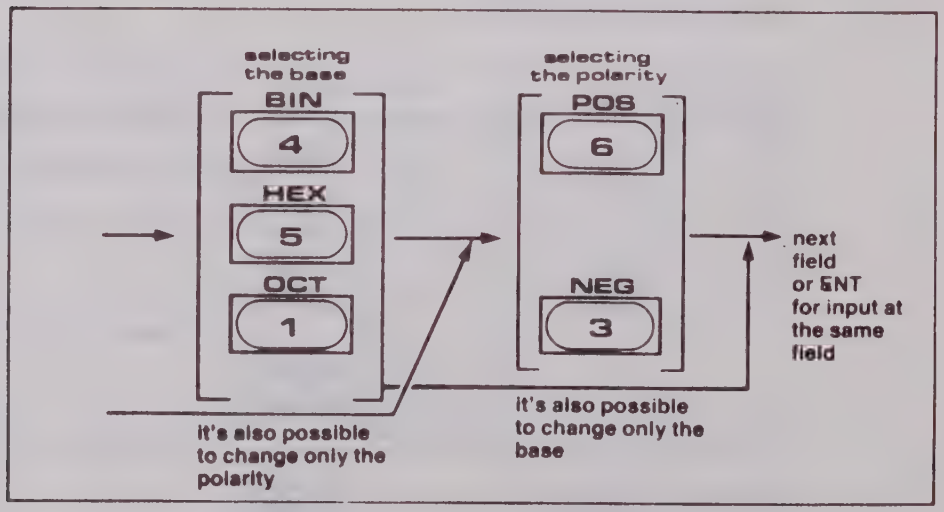
1) programming the first six words (or a part of them),
2) calling the second page for progamming the last six words (or part of them).

4.4.2.4.1 PROGRAMMING THE WORDS FOR SEQUENCE SEARCH

At every word field position it is possible to program a 48 bit word for search. (A,B,C,D,E,F)

Before the programming can be done, the cursor must be moved to the field of interest by using the keys of the EDIT group. The selected field then starts blinking. At this point it is possible to change the base for the triggerword to **BINARY, HEX** or **OCTAL** in positive or negative logic levels.

How to do it



Refer to the headline of the monitor for rapid help!

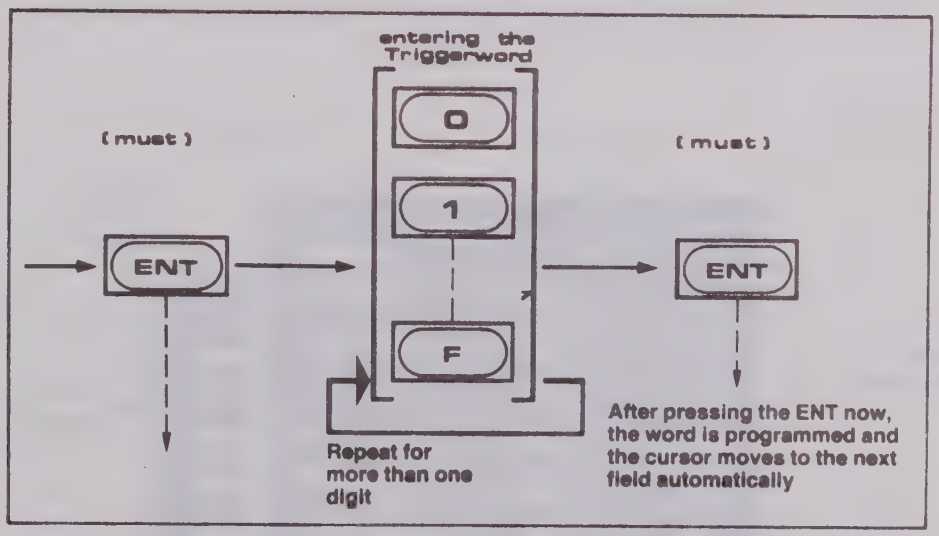
The change can be done at any position at any word number for any POD group (A,B,C,D,E,F), then the change is made for the selected POD of every position in both pages for this POD group.

Programmed words are automatically changed to the next new base and polarity.

Now the user can program the words. He also can program the words without changing the base or polarity. It is only a possibility.

First the cursor must be moved to the field of interest by using the keys of EDIT group. Then this field starts blinking. Now it is possible to enter the word of interest depending on the programmed base.

How to do it



After pressing the [ENT] key the blinking of the whole field changes to blinking of the digit now available to program.

The [◁] [▷] keys can be used to skip positions of the word field.

4.4.2.4.2 CALLING THE SECOND PAGE

To call the second page the user has to select the PAGE field.

Then by pressing the ROLL key

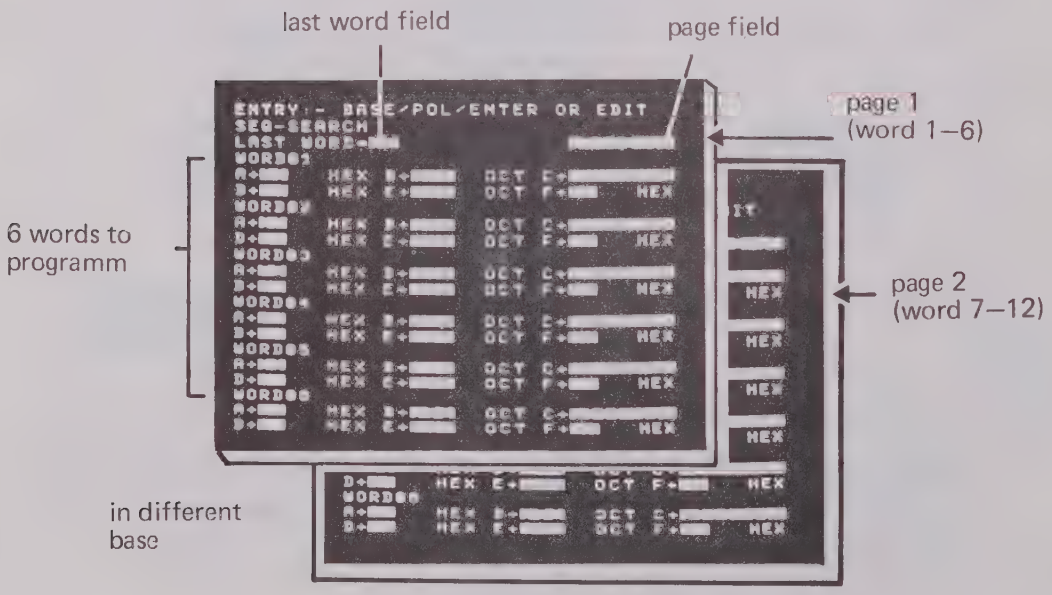
the Page 1 is changing to Page 2. Pressing again call back the page 1 and so on.

The programming of the 6 words in page 2 is the same like explained in the chapter before.

4.4.2.4.3 DEFINING THE NUMBER OF WORDS FOR THE SEARCH

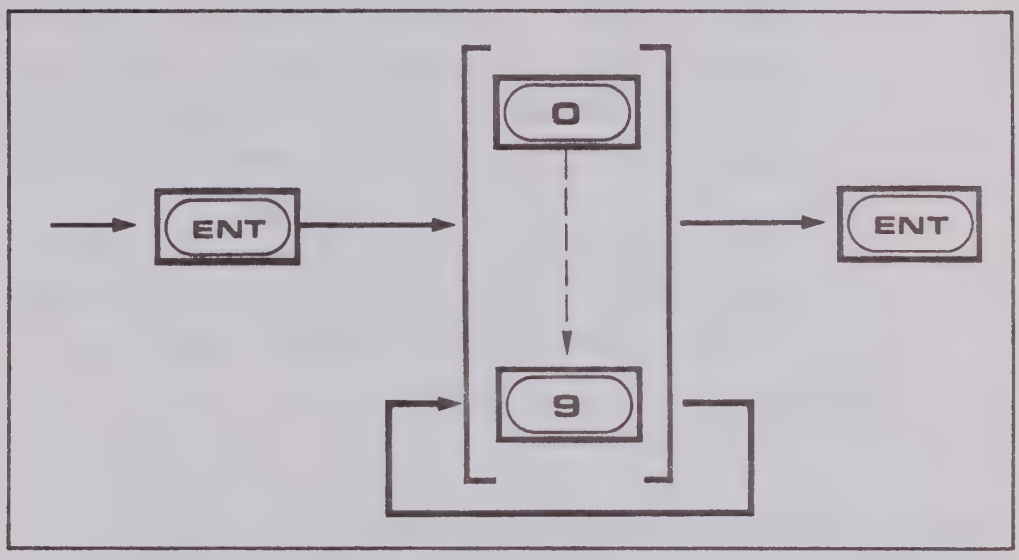
One parameter is very important for the sequence search. It is the number of the last word counting from word # 1 for the sequence.

It means, the user can program a maximum of 12 words in this two pages.



4.4.2.4.3 (continued)

But he can also pogram a number of words in the range from 1 to 12. Every time he has to program the last word of the sequence he likes to see in the LAST WORD field



EXAMPLE: (last word should be word # 6)

		A	B	C	D	E	F
Sequence for search	WORD 1 =	1F	XX	XX	XX	XX	XX
	WORD 2 =	XX	AA	01	XX	XX	XX
	WORD 3 =	XX	XX	XX	XX	XX	XX
	WORD 4 =	4F	C1	C3	00	XX	1F
	WORD 5 =	40	XX	XX	XX	A3	XX
	WORD 6 =	7F	XX	XX			
	.						
	.						
	.						
	.						
	WORD 12						

In this example it becomes understandable what the user can do. There is really no restriction in the programming the words.

4.4.2.4.3 (continued)

The sequence search starts by pressing the EXECUTE key while the analyzer is showing one of the two pages of the words. The search is done in the range of search area (see chapter 4.4.2). To call back another analyzer function (e.g. LIST, TIMING, MENUE, etc.) without executing the sequence search, the user may press the depending key to call this other functions. Programmed words at any page are fixed for further use or reprogramming.

After the end of the search the analyzer calls back the function from where the sequence search is initiated (LIST or TIMING mode).

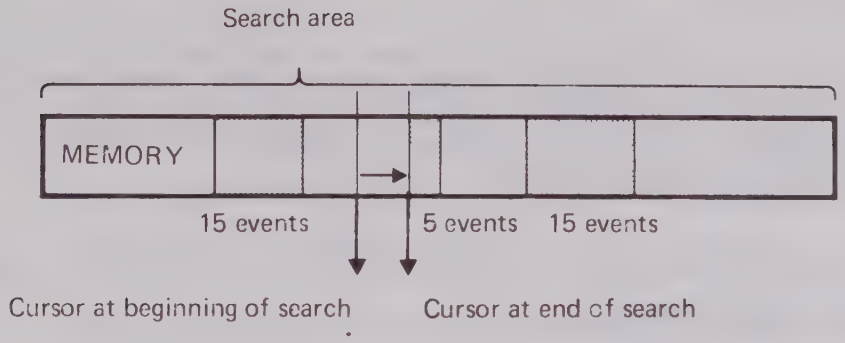
4.4.3 AFTER EXECUTING THE SEARCH

At every event which is true to the programmed function an internally counter is incremented beginning from 0. If the search is finished the value of this counter is shown on the display. The current cursor position after the search becomes automatically the position of the next event, depending to the cursor position at the beginning of the search.

The direction of this cursor move goes to the higher numbers of memory location. Additional to the total number of events there is a message at what event, depending of the beginning of the search area the cursor is now located.

4.4.3 (continued)

EXAMPLE:

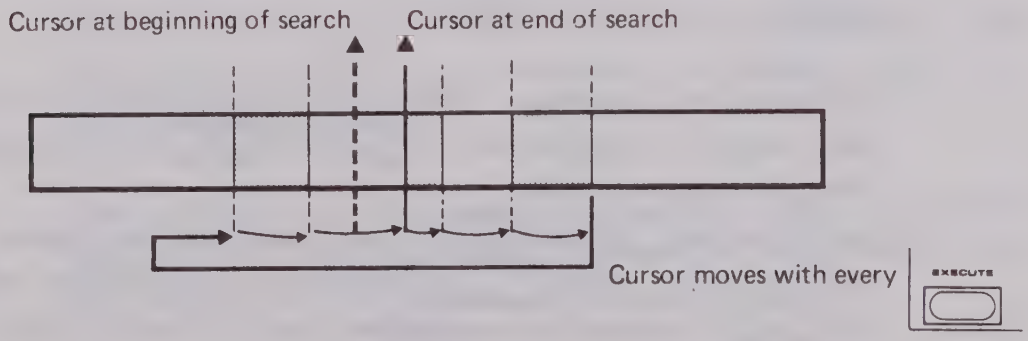


message :

SEARCH EVENT 0016 TOTAL 0035

Now the user can move the cursor to the memory, depending on the location of true events by pressing the EXECUTE key again and again and.....
Then the cursor moves from event to event. If there are more than one events immediately togehter (like a block of e.g. same words) the cursor moves first to the beginning of this block and at the next EXECUTE to the end of this block then to the next event (or beginning of the next block), always shown the actual number of events. If the last highest number of events in the memory has been reached, the cursor moves at the next EXECUTE to the first event from the beginning of the memory (or search area).

EXAMPLE:



So the user can step to the points of true events very simple.

Between every EXECUTE after search the user can move the cursor random to any position without to loose the function of execute.

The next pressing of EXECUTE then follows the same rules just discribed.

But this is only possible by moving the cursor with the [◁] [▷] keys. Modifying the display with other functions is closing the after search function completely.

So long as the message about the search results is available on the display, the EXECUTE function to move the cursor, is also available.

The search result from the sequence search is the same but additional there are signs at the information lines to make it more understandable

The cursor also moves automatically to the next beginning of a true sequence in the direction of higher numbers of memory locations.

The complete sequence (depending of the number of the last word) is explained by [>] and [X] at the beginning of the dataline.
The blinking [>] or [X] is marking the beginning of the sequence, where [>] is showing a programmed value and [X] a complete programmed don't care at all active inputs.

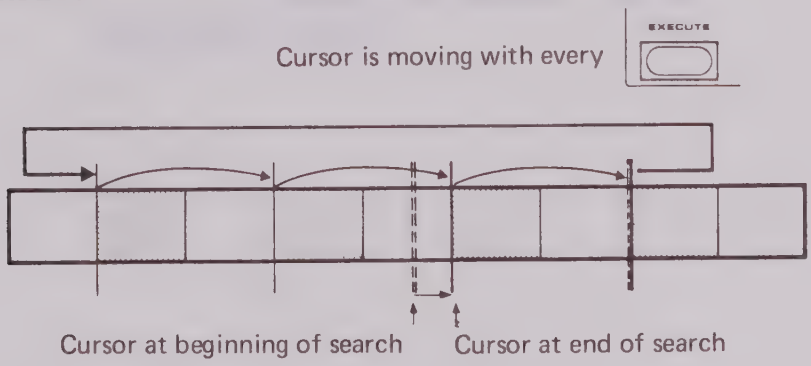
4.4.3 (continued)

Then the whole programmed sequence (which was found by searching) is marked in this way.

After sequence search the analyzer returns also back with the same message lik in the other search modes. But the number of total events now means the number of completely founded programmed sequences, not the number of single words containing in a sequence.

And different to the other search modes, by pressing the execute key now the cursor moves to the beginning of the next sequence and not to the end of the current sequence.

EXAMPLE:



Like the other search functions the user can move the cursor by pressing the keys without loosing the function of EXECUTE. This function is always available so long as the message about the search results are present at the display. By moving the cursor after sequence search the signs are located at the beginning of a dataline also moving. They are fixed internally so long as the message about the results is present.

These signs are only present in LIST mode. In TIMING mode always the same explained rules are valid but the signs are not present (too small space).

4.4.4 COMBINATION OF DIFFERENT MODES

To use the search modes there are no restrictions for the user to combine it with other display functions. So it is possible and very helpfull to combine e.g. memory function S+R with SRCH S ≠ R in timing or list mode

Only one rule: every select for memory function, timing arrangement, or list programming must be done before calling any search function. If the user now thinks about a search after an automatic compare in combination with different memory functions, he can imagine what support the LAM 4850A can be depending on this analyzing power.

The Scratch Memory

- How to save the set up for further use

PAGE

5. **THE SCRATCH MEMORY** 5-1

5.1 HANDLING OF THE SCRATCH MEMORY FOR SINGLE FILES 5-2

5.2 HANDLING THE SCRATCH FOR RECALL MULTIPLE FILES 5-4

5. THE SCRATCH MEMORY

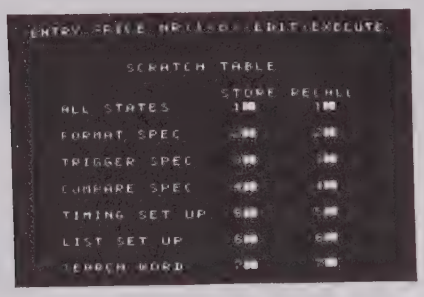
The scratch is a battery backed up C-MOS memory to store different programmings of the LAM 4850A.

The user has the possibility to save a complex MENU programming for further use. Information in this scratch memory is held up to 3 months without main power.

The scratch memory is organized into a matrix 6 of 6. For 6 different types of programming (e.g. trace menue, trigger menue...) the user can store 6 different set ups (files).

FILE / TYPE		#1	#2	#3	#4	#5	#6
format spec	2	2.1	2.2	2.3	2.4	2.5	2.6
trigger spec	3	3.1	3.2	3.3	3.4	3.5	3.6
compare spec	4	4.1	4.2	4.3	4.4	4.5	4.6
timing setup	5	5.1	5.2	5.3	5.4	5.5	5.6
list setup	6	6.1	6.2	6.3	6.4	6.5	6.6
search word	7	7.1	7.2	7.3	7.4	7.5	7.6
		C - MOS MEMORY					

Pressing the SCRATCH key of the specific group the user can call a table to select a special file for store or recalling a programmed set up.



5.1 HANDLING OF THE SCRATCH MEMORY FOR SINGLE FILES

At the left hand side of the display are shown the types of file groups and on the right hand side are the number of files the user can select. There are two rows. The right row has to be selected for recalling a set up, the left row has to be selected for store a set up into the scratch memory.

By using the keys the user can move the cursor to any field of both rows. The selected field then starts with blinking and now the user may enter a number in the range from 1 - 6 to specify the file number. He can input the number directly by pressing the depending key. The ENT key is not necessary at the scratch table. Then by pressing the EXECUTE key the information of an set up is stored to the memory or recalled from the memory depending of the selected row.

After pressing the execute key the analyzer returns the display back from where the scratch table was called by pressing the SCRATCH key.

Also by calling the cratch table the analyzer selects automatically the type of file depending from where the scratch table was called.

EXAMPLE

The user is analyzing the data in LIST mode, now he likes to recall a new TRIGGER menue from the scratch memory for the next recording.
By pressing the SCRATCH key the file type # 6 (LIST SET UP) is selected because the call was made from list mode.
Now the user selects the right type of file (Trigger Spec.) and then the number of file he wants (e.g. 4) in the recall line. By pressing the execute key this file (e.g. 3.4) is recalled and then the trigger menue is set to this new parameters.
The analyzer immediately returns back to list mode for further work.

Every execute of recall or store forms an increment of the selected file number in the row only where the execute was done. So at next call the scratch table the depending file number is automatically the next. (From 6 it returns to 1.)

At the menue display there is a message about the recalled file number in the second line from the top at the right. Normally this message shows the number of file type as an "X" to sign this set up is never stored.
At the same moment where a store or a recall is done from the scratch table, the "X" is changing to the depending file number. (See figure)

So the user always gets an information about the contents of the scratch table.

If the user has recalled a menu from the scratch memory and then later on is changing the menu by new programming any parameter, this file number is changing again to "X". On the other side if the user has programmed a menu while the "X" is showing and the user reaches a point where the result of this programming is just the same like a stored set up from the same menu, the "X" is changing then to the number where the same set up is stored. So the user never looses control about the state of the scratch memory.

Another important point: If there are the same set ups stored in more than one file (e.g. 4,5,6 are the same) and the user recalls file number "6" the message on the display of the recalled menu about the file contains "4", the most less number of the files with the same contents. So the user knows he can use file "5" and "6" for other different set ups.

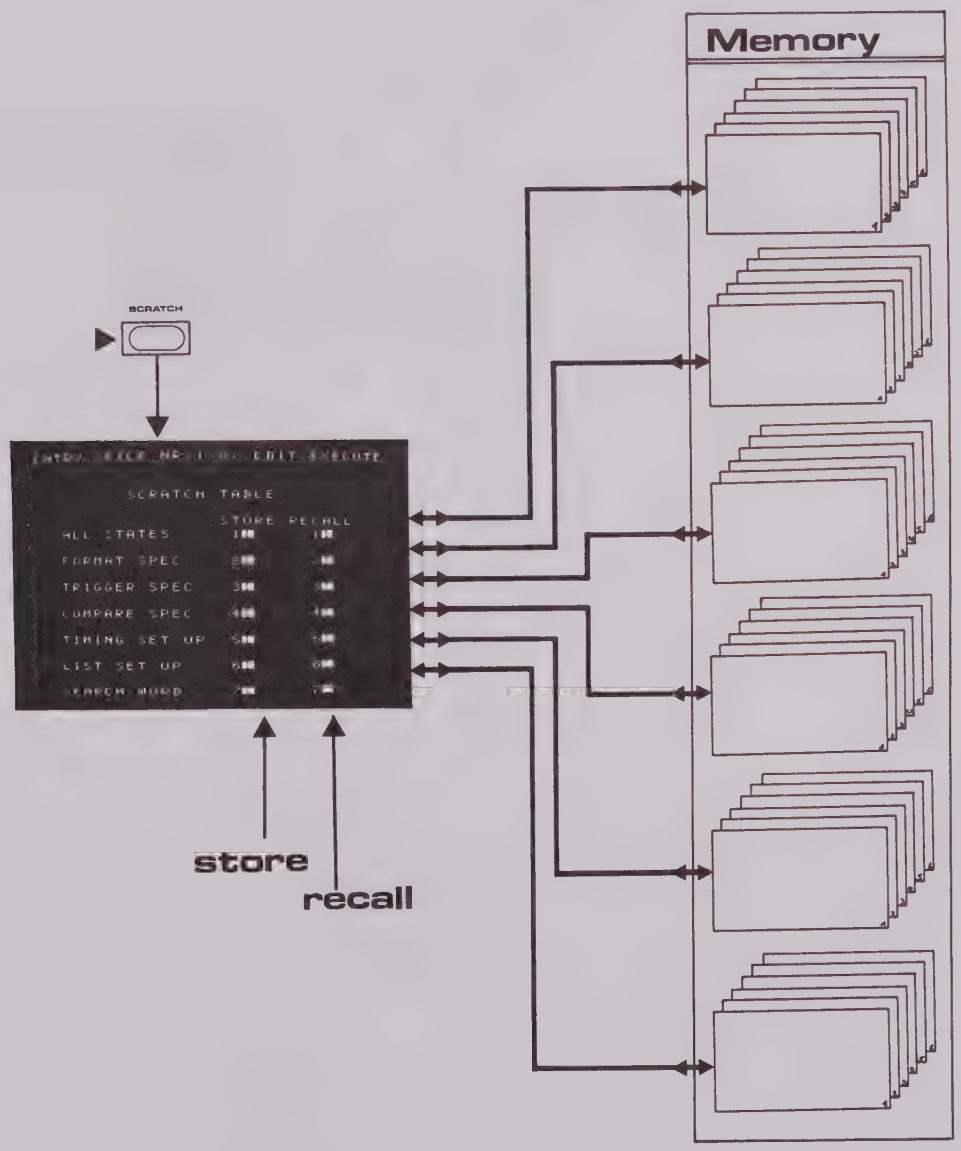
5.2 HANDLING THE SCRATCH FOR RECALL MULTIPLE FILES

If the user likes to recall or to store a complete set up for the analyzer, it means all types of files, then he can do it at one time with only one execute.

To do this he has to select the first file type 1 **ALL STATES** and, like explained in the last chapter, selecting a file number for store or recall and then EXECUTE.

Now the store or recall is done at all available file types (2-6) depending to the selected file number.

This feature is very helpful by saving a complete set up before power up or to program the anylzer after power on in a very simple way.



The same rules explained for single file handling are also valid for using ALL STATES.

Interfacing

- How to get remote control of the LAM 4850 A

GENERAL PURPOSE INTERFACE BUS

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GENERAL PURPOSE INTERFACE BUS

1. GENERAL

1.1 INTRODUCTION

The GPIB is accepted as the industry standard for programmable instrumentation. By complying with the IEEE 488-1978 standard (revise from 1975), instrument and controller manufacturers are now able to offer the broadest spectrum of programmables ever available. This gives the user the opportunity to optimize his own system by selecting instruments from a variety of manufacturers and be assured that they will all operate well together after a simple hookup.

The GPIB requires no external custom-designed interface between instruments. It uses relatively few program lines and is simple enough to implement that a microcomputer or programmable calculator is sufficient as system controller. The system approach to instrumentation has many benefits: operator fatique is not a factor, so results are consistent, and automated systems are faster, more repeatable and more accurate than error prone manual testing.

Several different types of instruments may be working as a system on the GPIB. The controller is a computer or calculator capable of controlling all bus activity. It contains the program, or driver, which defines the system's function and is the source of data for all setups of instruments with listener capability. It also receives or directs to listeners the data generated by devices with talker capability.

Among its bus management duties, the controller directs (addresses) talkers to transmit data and listeners to receive data. Generally, talkers receive real inputs (voltage, frequency, magnetic tape) and transmit data. Listeners generally receive data (parameter settings) and output control information to the test system.

1.2 GENERAL INFORMATION

The GPIB Interface allows the user to control most functions of the LAM 4850A Logic Analyzer remotely from the IEEE 488 instrumentation bus. Furthermore, it enables the transfer of data recordings to other GPIB compatible devices. The electrical interface uses standard IEEE 488 open collector drivers with passive terminations.

All data transfers occur in standard US ASCII coded characters (7 bit, i.e., parity always reset). The interface supports two modes of operation:

1) Talk only mode for the transfer of data to a non-addressed device such as a listen only printer. (This mode is not yet implemented).

2) Talk/listen (addresses) mode for the control of the instrument in a test system environment with separate controller.

These two modes of operation are selected by a rear panel switch. In addressed mode operation the instrument responds to a selected primary address (selected by rear panel switches) in the range 0-31 decimal. Addressed 0-30 may be used as the talk/listen address (mta, mla) of the instrument address 31 is used by the bus controller to deaddress (unt, unl) the instrument, thus it may not be used as a talk/listen address. Secondary addressing is not used by the LAM 4850A.

Programming of the instrument is accomplished by selecting various 'menus' or programmable function groups by the character 'M' followed by a letter to select the different groups of functions.

The trigger menu is used to set up the trigger conditions for a data recording including trigger clock source.

By means of the trace menu the input memory blocks contained in the LAM 4850A may be configured in one of two ways in order to create the 1k or 2k mode. Trigger delays for capture of post/pre-trigger data, clock selection qualifiers, the internal timebase, and logic thresholds are also controlled by use of this menu.

The compare menu (MC) allows configuring the LAM 4850A for the compare mode of operation. This mode enables the LAM 4850A to compare data stored in the reference memory to that stored in the source memory. Results of the compare scan are indicated on the displays. Please note that attempts to program the compare menu without previously recording data will result in programming errors. This helps prevent comparing erroneous data.

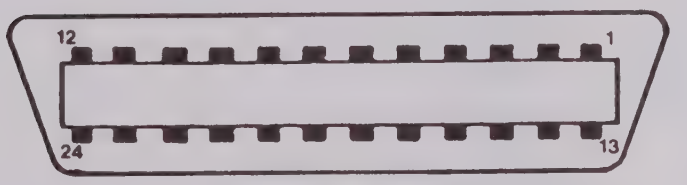
The integrated display of the LAM 4850A may be controlled by use of the list and timing menu. This allows a user to control display format from the GPIB bus and use the built in display for evaluation of results.

The transmit menu allows the user to select recorded data to be transferred over the GPIB bus. A system controller can select data channels and address ranges to be transferred after a data recording.

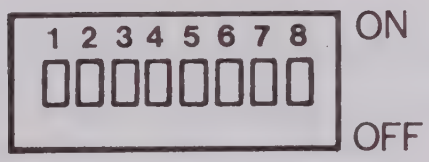
2. PROGRAMMING

2.1 HARDWARE SETUP

G.P.I.B. interface connector and address selective switches located on the rear panel of the LAM 4850A.



IEC-BUS



The connector is complete defined in the ANSI/IEEE STD 488-1978.

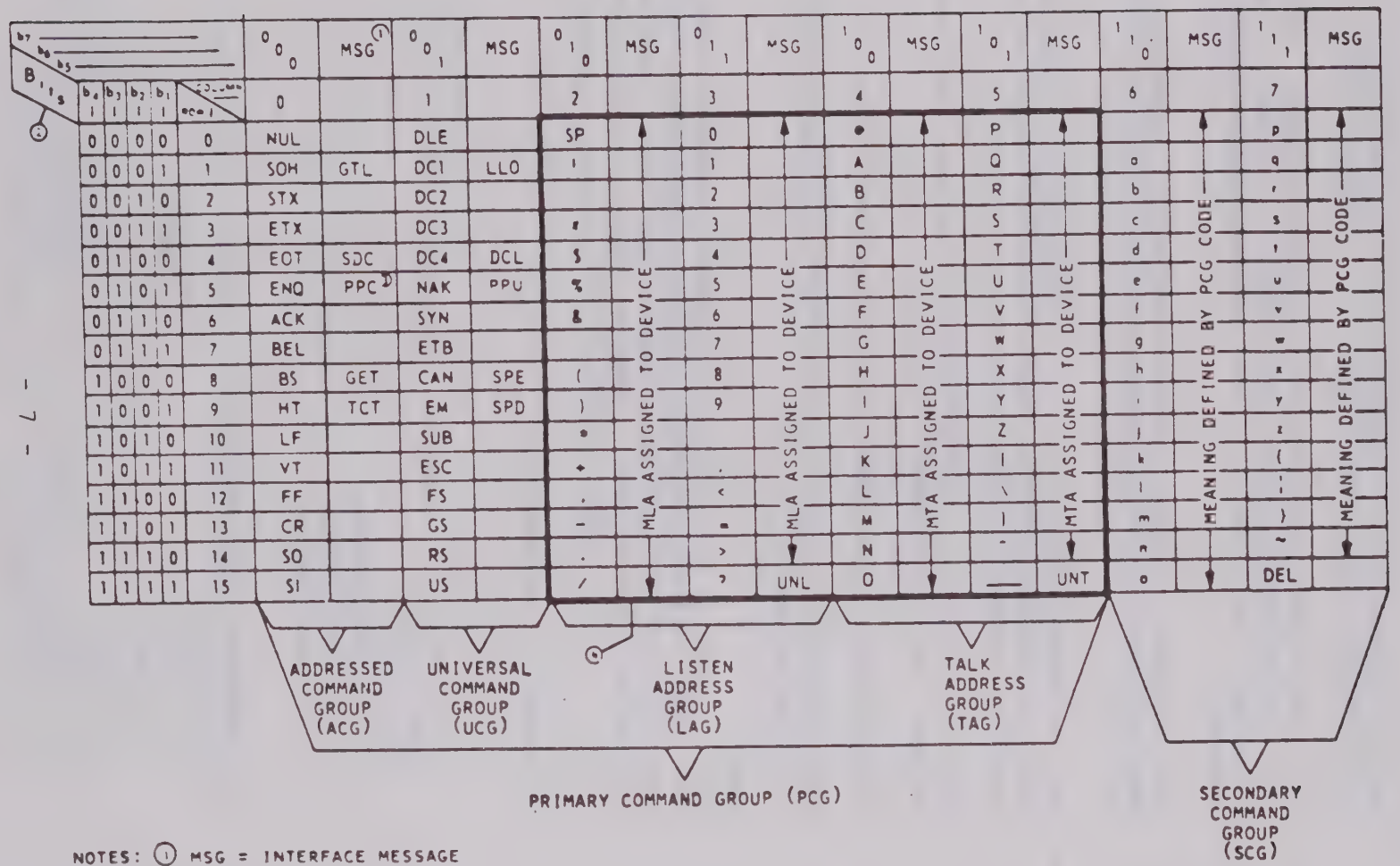
2.2 ADDRESSING

An eight pole address switch is located below the standard GPIB connector. The switch controls the talk and listen address of the LAM 4850A. It is labeled one through eight. The ON position specifies a one in the binary bit weight position as shown in the table following:

S 1	value 2^0
S 2	" 2^1
S 3	" 2^2
S 4	" 2^3
S 5	" 2^4
S 6	reserved for future use
S 7	reserved for future use
S 8	reserved for future use

Please note from the following table that the above switch settings actually select an address pair, one for talk and one for listen. For instance, if 16 decimal (0010000 Binary) were selected the controller would send an ASCII Zero (48 decimal, 0110000 Binary) for a LAM 4850A listen address command and an ASCII "P" (80 decimal, 1010000 Binary) for a LAM 4850A talk address. Also, address 31 decimal may not be used because this address pair is reserved for untalk and unlisten control.

(SENT AND RECEIVED WITH ATN=1)



NOTES: (1) MSG = INTERFACE MESSAGE
(2) b_1 = DIO1...b_7 = DIO7
(3) REQUIRES SECONDARY COMMAND
(4) DENSE SUBSET (COLUMN 2 THROUGH 5)

3. PROGRAMMING RULES

3.1 Valid Alphanumeric characters are: A to Z and 0 to 9, all letters upper case only.

3.2 The LAM 4850A contains of an 800 character buffer in which GPIB instructions are loaded. Therefore a command statement can consist of maximum 800 alphanumeric characters.

3.3 Each command string has to start with a supervisor (see section 4.8) or "M(X)" command, where X is one of the R, T, C, D, F, X, P commands.

3.4 All commands (consisting of a mnemonic and a parameter) must be separated by a space. Immediate supervisor commands are always effective.

3.5 While the LA is busy it will not accept any commands, except the stopcommand "%".

3.6 The character line feed "LF" is ignored by the LA.

3.7 The character carriage return "CR" is treated by the LAM 4850A as a space.

NOTE
After power up the LA will prepare selftest results in the GPIB transmitbuffer, the user can now read this buffer with the MP BS command and will receive the following informations: (over standard serial interface)

T = XX, C = XX, O = X

T = Memory Test Results

2^7 = N.U.
2^6 = N.U.
2^5 = N.U.
2^4 = N.U.
2^3 = N.U.
2^2 = EPROM ERROR
2^1 = CMOS ERROR
2^0 = RAM ERROR

C = Hardware Configuration

2^7 = N.U.
2^6 = N.U.
2^5 = N.U.
2^4 = N.U.
2^3 = N.U.
2^2 = SBLA E+F OFF
2^1 = SBLA C+D OFF
2^0 = SBLA A+B OFF

(SBLA = Memory Block)

NOTE

Bit 2^2, 2^1 or 2^0 is high when SBLA board is defective or totaly missing.

O = Availble Options

If no option is installed the LA will send an X, otherwise the last part of the option part number will appear.

4. COMMAND DESCRIPTION

4.1 Setup Programming

MR Trace Menu
MT Trigger Menu
MC Compare Menu
MD Timing Diagram
ML Date List arrangement
MO Option activate

4.2 Search Process

MF Search Menu

4.3 Scratch Memory Handling

MS Scratch Menu

4.4 Monitor Results

MV Monitor Results

4.5 Display Control

MW Display control command

4.6 Batch file control

MB Batch Menu

4.7 Special commands and serial interface commands

MH Cursor Menu
MY Coded Information
MP Print Menu
> Activate Echo (default)
< Desactivate Echo

4.8 Immediate and supervisor commands

If an immediate command is detected by the LA this will not be written into the command buffer, rather the LA will handle the command direct after occurance.

4.9 Immediate commands are:

% - Stop any activity

This command stops any LA activity. This function is similar to the STOP button on the LA's key board, but additionally the print and search process will also be aborted.

NOTE
The stop command is the only one which is accepted while the LA is busy.

*** - Reset the LA**

Sending this command to the LA it will be reset, turned into default and it will prompt with the power up message. After sending the reset to the LA the GPIB controller has to wait for diagnostic completion otherwise the bus will hang up. Power up selftest will take approx. 20 seconds. (This time depends on the number of pluged-in options.)

NOTE
The batch file area will be also cleared by sending the reset command.

, - Execute string buffer

Executes the present command string, this command will be ignored during the LA is busy with compare or search process, datatransfer from source to reference memory or with printout to the serial interface. During the data-recording this command is also not executed. In these cases it is recommended to read the LA status (see section 17.) after each execute command. If the status is not ZERO the LA will not accept any commands and send "GPIB Command Error" (see section 17.2).

(- Receive data

Prepares the LA to receive data from the GPIB controller, an ")" signalizes the end of the data transmission. After sending the data to the LA it will check and record for proper byte count and correct checksums. If any fail block occurs it will be copied into the transmit buffer and causes a "Data Transmission Error" (see section 17.2) accompanied by "SRQ" and error flag. Correct blocks are stored depending to the selected SRC/REF memory configuration. If the data transmission begins with "(T" that means for the LA to receive text (ignoring CR and LF).

NOTE
The "(T" command needs a delay of at least 150 ms before execution through the "MW B" command.

/ - Check string buffer

Checks string buffer for syntax and valid parameters. If an error is detected during this check cycle, execution will not be started, the LA sends out the SRQ with error flag and error code, furthermore the failed part of the string will be copied to the transmit buffer, so that the user can read it, and modify the failed part.

= - Continue execution

Continues execution of the command string, aborted by previous halt command (supervisor command).

$ - Clear command buffer

Clears the command buffer. This is recommended if it is wanted to avoid the execution of a previously sent command string.

[- Receive batch file

Refering to section 16., this command stores the following command string up to "]" into the specified batch file. The terminator]includes also checkprocedure before storing.

4.9.1 Supervisor Commands:

& (N) Data select

N = S Source data

N = R Reference data

N = X Source EXOR to reference (if the source data are shown in the LA's display)

N = X Reference EXOR to source (if the reference data are shown in the LA's display)

N = T Transfer source to reference

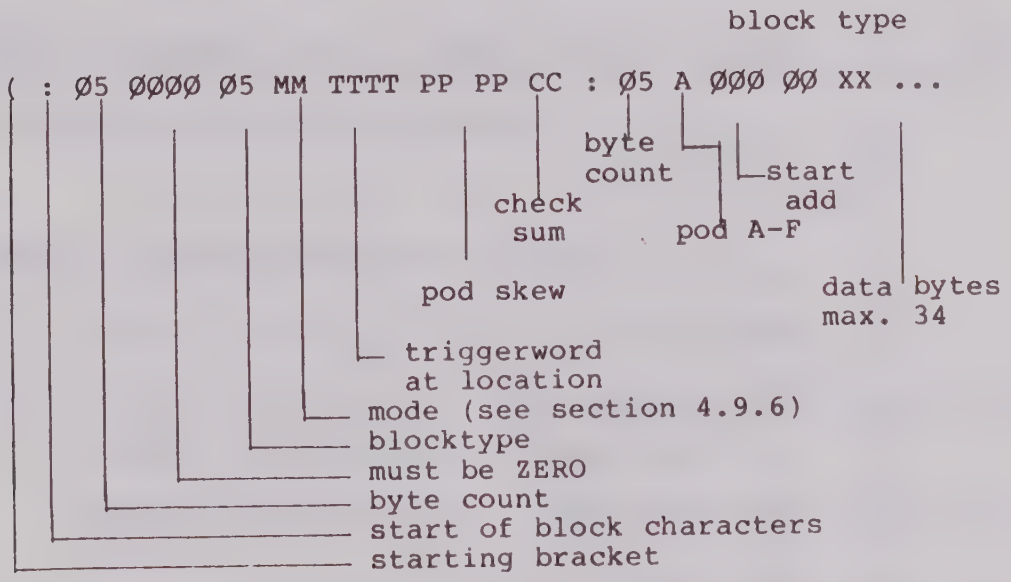
NOTE

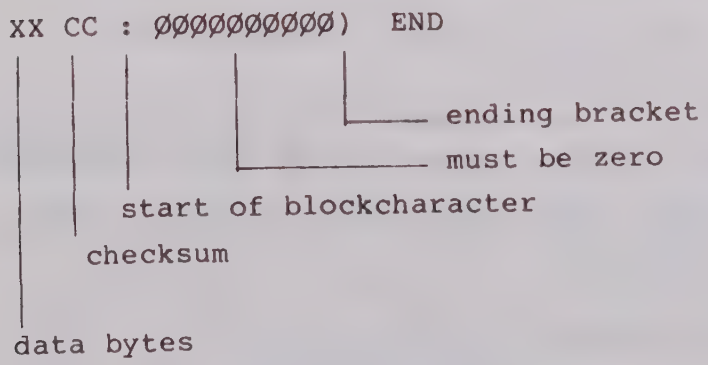
If no data select command is sent to the LA, deafault is source data.

4.9.2 ! (N) Format for data transmission

Before the data transmission command MX (see section 11.) is sent, first a data format command ! (N) has to be sent. There are four different types of transmission formats.

4.9.3 ! 1 block transmission mode (





4.9.4 ! 2 Commodore PET compatible instead of : a S

```
(SØ5 ØØØØ ØR MM TTTT PPPP CC   CR ØØ
 SØ5 AØØØØØ XX .... XX CC      CR ØØ
 SØØØØØØØØØØ                   CR ØØ
 END
 Format 2 with S, CR and ØØ
```

4.9.5 ! 3 GPIB standard transmission mode

```
(:Ø5ØØØØØ5MMTTTTPPPPCC    CR LF ØØ
 :Ø5AØØØØØXX...XXCC       CR LF ØØ
 :ØØØØØØØØØØ             CR LF ØØ
 END
 Format 3 with CR, LF and ØØ
```

4.9.6 ! 4 Format 4 is the same as 2 but instead of S there is :

Mode information
bit description

2^7	N.U.
2^6	N.U.
2^5	N.U.
2^4	0/1 sample/latch
2^3	0/1 1k/2k mode
2^2	0/1 E+F ON/OFF
2^1	0/1 C+D ON/OFF
2^0	0/1 A+B ON/OFF

4.9.7 ? (N) Data recording

The execution of this command will be ignored if the setup is in error and the error status will be copied to the transmit buffer. There are three different modes to start the data recording.

? S	Data recording
? D	Date recording and preparation
? C	Start the compare process (Compare results see Sect. 9.8)

4.9.8 ' Set SRQ

4.9.9 # Halt execution

If this command is encountered during execution of a command string the execution is halted and the LA now waits for continue, execute or stop (supervisor commands) all other commands will be ignored.

NOTE

The LA will abort any activities also the halt execution, if it reaches the stop command.

5. SERIAL INTERFACE IMMEDIATE COMMANDS

	Delete last character from string buffer
CR	Initialize baud rate after power up. Execute string buffer. Display next location (valid for the MP C command (see section 14.)
,	Execute command string from the beginning of the string
^	Display previous location (valid for the MP C command)
S	Display status info (but only when the LA is busy)

6. OPTION ACTIVATE MO

This command is used to call up all the options which can be installed in the LAM 4850A. The special GPIB/Serial interface commands for the options are described in detail in the option operating manual.

List options
MO L(N)
N = A = ASCII name
N = C = Code = X (bank no.) XX (part no.)

NOTE

The option list will be prepared in the transmit buffer.

access option
MO A(N)
N = 02-XX = part number

7. PROGRAM TRACE MENU COMMAND (MR)

A trace menu command is indicated by an (MR) followed by a sequence of character groups separated by single space character which modify certain parameters in the trace menu. The trace menu command is executed by sending one of the execute control characters following the last character in the command sequence. If additional trace menu programming is desired before another command type is initiated the (MR) need not be repeated. Any field left unprogrammed by omitting it from the sequence will result in previously stored or default data left in that field.

7.1 Analyzer Sequence Field S(N)

N = 0 = 32 bit mode
N = 1 = 48 bit mode

7.2 Go Field G(N)

N = 0 Manual
N = 1 Repeat

Repetition delay R (N)
N = 00 99 (time in seconds)

Trigger delay D (N)
N = 0000 8192 samples for trigger delay

Pod skew B (N)
N = 0000 1000 Pod skew

7.3 Pod Selection P(N)

Designates the pods for:
N = A Pod A & B
N = C Pod C & D
N = E Pod E & F
N = Q Clock and Clock Qualifiers.

7.4 Pod Fields P(L)

designates the pod for 6.6, Level Field; 6.7, Input Field; 6.8, Clock Field; and 6.10, Frequency Field.

7.5 Level Fields L(N)

used in conjunction with, and must follow, a pod field sequence. Order independent from the input, clock and sample rate fields.

```
N = T  TTL 1.4 volts
N = 1  V1 Field level see sec. 6.13
N = 2  V2 Field level see sec. 6.13
N = E  ECL - 0.6V
```

7.6 Input Fields I(N)

Used in conjunction with, and must follow, a pod field sequence. Order independent from the level, clock, and sample rate fields.

```
N = S  Sample Mode
N = L  Latch Mode
```

7.7 Clock Field C(N)

Used in conjunction with, and must follow, a pod field sequence. Order independent from the level, input, and sample rate fields.

```
N = 1  Internal
N = 2  external clock 1
N = 3  internal or external clock 1
N = 4  external clock 2
N = 5  internal or external clock 2
N = 6  external clock 1 or external clock 2
N = 8  external clock 3
N = 9  internal or external clock 3
```

7.8 Pods ON/OFF O (N1N2)

```
N1 = A Pod A & B
N1 = C Pod C & C
N1 = E Pod E & F

N2 = N Pod ON (active)
N2 = F Pod OFF (inactive)
```

7.9 Internal clock rate F (N)

N =	00	20 nanoseconds
=	01	50 nanoseconds
=	02	100 nanoseconds
=	03	200 nanoseconds
=	04	500 nanoseconds
=	05	1 microsecond
=	06	2 microseconds
=	07	5 microseconds
=	08	10 microseconds
=	09	20 microseconds
=	10	50 microseconds
=	11	100 microseconds
=	12	200 microseconds
=	13	500 microseconds
=	14	1 millisecond
=	15	2 milliseconds
=	16	5 milliseconds
=	17	10 milliseconds
=	18	20 milliseconds
=	19	50 milliseconds
=	20	100 milliseconds
=	21	200 milliseconds
=	22	500 milliseconds

7.10 Qualifier fields Q (N1N2N3)

N1 = 1 external clock 1
N1 = 2 external clock 2
N1 = 3 external clock 3
N2 = 1 qualifier 1
N2 = 2 qualifier 2
N2 = 3 qualifier 3
N3 = H active high
N3 = L active low
N3 = X don't care

7.11 External clock edge fields E (N1N2)

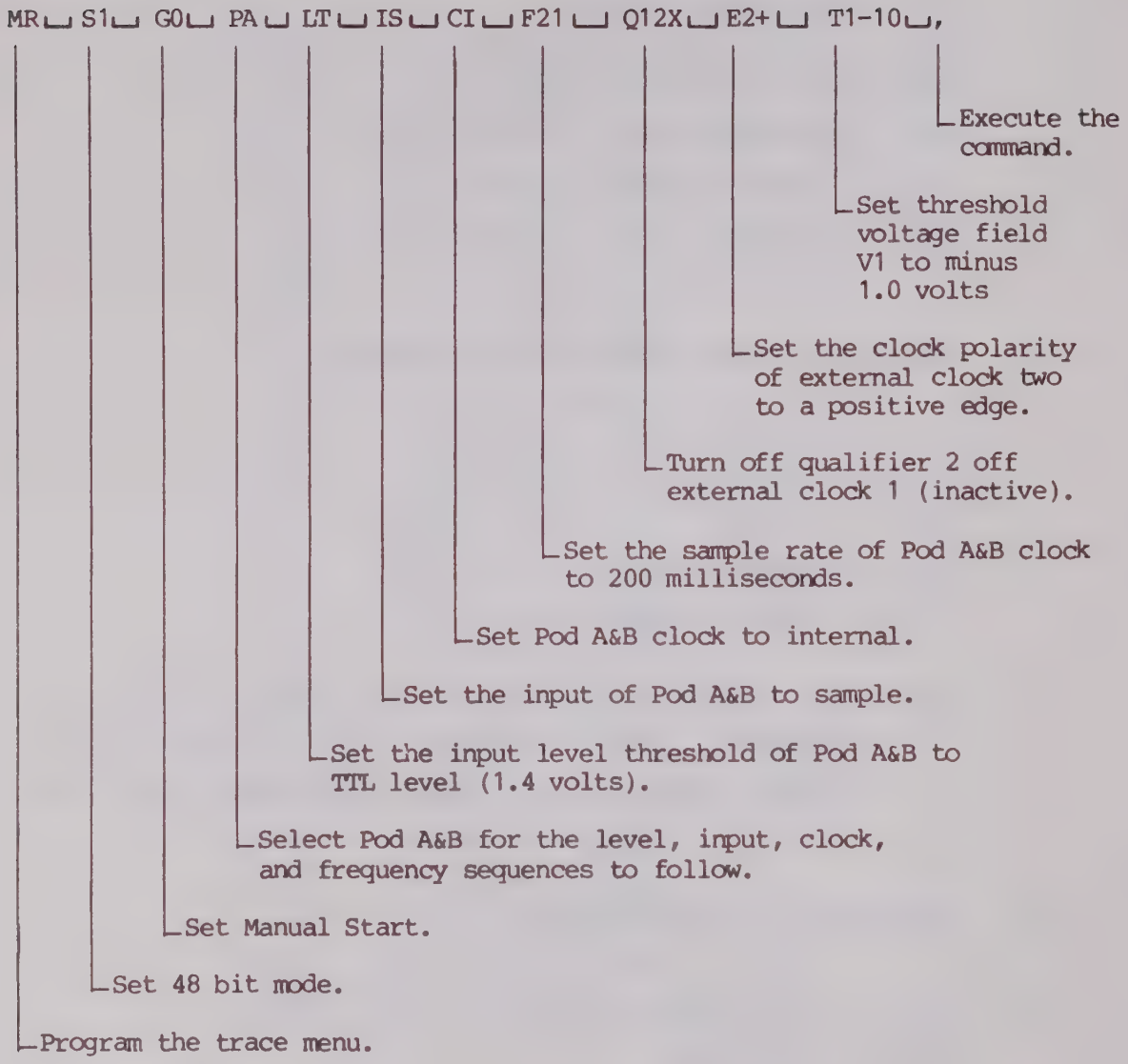
N1 = 1 clock 1
N1 = 2 clock 2
N1 = 3 clock 3
N2 = + rising edge
N2 = - falling edge

Note: If attempt to program this field is made with internal clock selected in all two clock fields (Sec.6.8) an error condition will result.

7.12 Threshold Fields T(N1N2N3)

N1 = 1 V1 field
N1 = 2 V2 field
N2 = + positive voltage
N3 = - negative voltage
N3 = 0 to 99 for 0 to 9.9 volts in 0.1 volt increments.

7.13 Trace menu programming example



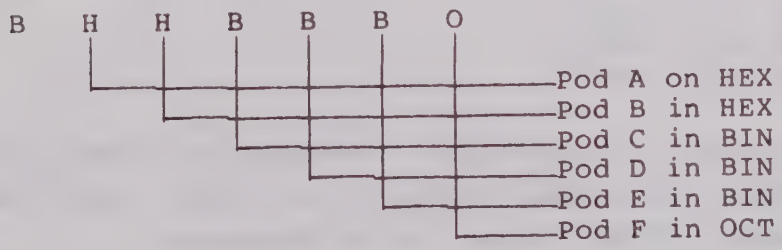
8. PROGRAM TRIGGER MENU COMMAND (MT)

A program trigger menu command is indicated by an (MT) followed by a sequence of character groups separated by single space characters which modify certain parameters in the trigger menu. The trigger command is executed by sending one of the execute control characters following the last character in the command sequence.If additional trigger menu programming is desired before another command type is initiated the (MT) need not be repeated.Any field left unprogrammed by omitting it from the sequence will result in previously programmed or default data left in that field.

Base for trigger combination B (N1-N6)

N1 - N6 = B for binary
= H for hexadecimal
= O for octal

Example



all six parameter are needed at everytime

8.1 Level Select L(N) Corresponds to the First Four Levels in the Trigger Menu.

N = 1 Level 1
N = 2 Level 2
N = 3 Level 3
N = 4 Level 4

Sets the level for the following function, event count, and POD trigger word sequences.

8.2 Function F(N)

Order independent from the event count and POD trigger word sequences but must follow level select sequence.

N = 0	START (level 1 only)
N = 1	FREE RUN (level 1) OFF (level 2 thru 4)
N = 2	THEN
N = 3	THEN NOT
N = 4	RESTART (Level 4 only)

8.3 Event Count E(N)

Order independent from the function and POD trigger for select sequences but must follow a level select sequence.

N = 1 to 255	For 1 to 255 event counts before moving to the next trigger level, trigger delay or trigger.

8.4 POD Trigger Word P(N combination)

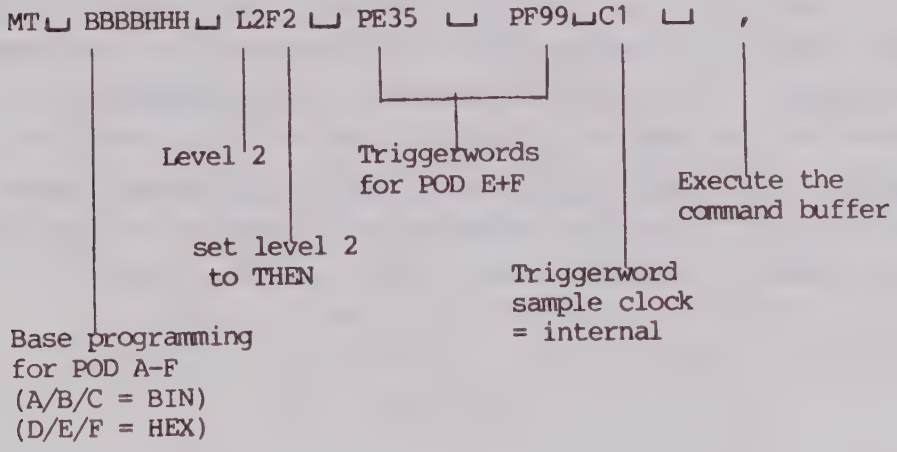
N = A	Pod A
N = B	Pod B
N = C	Pod C
N = D	Pod D
N = E	Pod E
N = F	Pod F

Combination = 2-8 digits depending on format. Order independent from the function and event count sequences but must follow a level select sequence.

8.5 Trigger Word Sample Clock C (N)

N = 1	internal
N = 2	external clock 1
N = 3	internal OR external clock 1
N = 4	external clock 2
N = 5	internal OR external clock 2
N = 6	external clock 1 OR external clock 2
N = 8	external clock 3
N = 9	internal OR external clock 3

8.6 Trigger Menu Programming Example



9. PROGRAM COMPARE MENU COMMAND (MC)

A program compare menu command is initiated by an (MC) followed by a sequence of character groups separated by space characters which modify certain parameters in the compare menu. The compare menu program command is set into execution by sending one of the execute control characters following the last character in the command sequence. If additional compare menu programming is desired before another command type is initiated the (MC) need not be repeated. Any field left unprogrammed by omitting it from the sequence will result in previously programmed or default data left in that field.

9.1 Start Address S(N)

Selects the starting address for the source and reference memory.

N = XXXX range of values from 0 to 999 or 0 to 1999 depending on the configuration selected in the trace menu.

9.2 End address E (N)

Selects the end address for the source and reference memory.

N = XXXX range of value from 0 to 999 or 0 to 1999 depending on the configuration selected in the trace menu.

9.3 Pod assignement P (N1 - N6)

Selects the POD data which is to be used in the compare process.

N1 - N6 = A, B, C, D, E, F

Pods which are not to be used in the compare process are omitted from the sequence and the remainder of the field is left justified.

9.4 Compare Mode B (N)

N = 0 BIT/BIT compare
N = 1 BYTE/BYTE compare

9.5 Skew Select K(N)

Selects range of skew, plus and minus, over which the selected data will be compared.

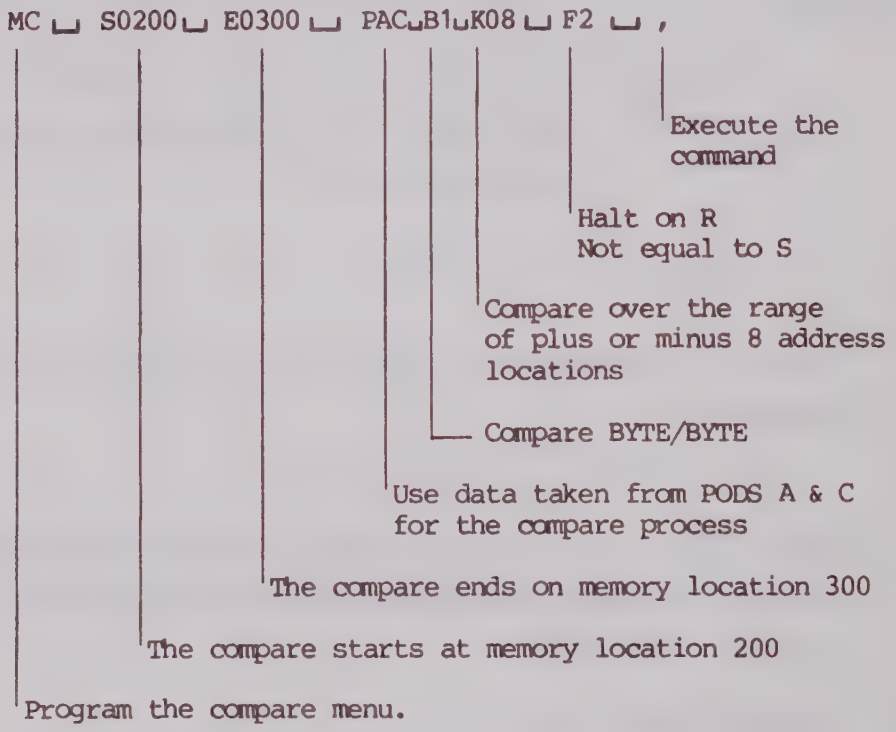
N = 00 to 99 for ranges of 00 to plus and minus 99 samples.

9.6 Function Select F(N)

Selects the compare condition

N = 0 Halt on R = S
N = 1 Halt on R ≠ S (not equal)
N = 2 Count on R = S
N = 3 Count on R ≠ S (not equal)

9.7 Menu Programming Example



9.8 After running the compare process the results can be read out over the serial interface with the following format:

C = Cycle count
T = Compare condition true
END

10. PROGRAM TIMING DIAGRAM COMMAND (MD)

A program timing diagram command is initiated by an (MD) followed by a sequence of character groups separated by single space characters which modify certain parameters in the diagram. The command is set into execution by sending one of the execute control characters following the last character in the command sequence. If additional timing diagram programming is desired before another command type is initiated the (MD) need not be repeated. Any field left unprogrammed by omitting it from the sequence will result in previously programmed or default data left in that field.

10.1 Channel Group Select P(N)

N = A display data from channel A & B
N = C display data from channels C & D
N = E display data from channels E & F

It is always depending on the sequence field (7.1) in the trace menu.

10.2 Scale Select X(N)

Selects the time scale of data selected on the display.

N = 1	X1	Times one	
N = 2	X10	Times ten	(x5 in 48 ch. mode)
N = 3	X20	Times twenty	(x10 in 48 ch.mode)

10.3 Channel Display and Position Command C(N1N2N3)

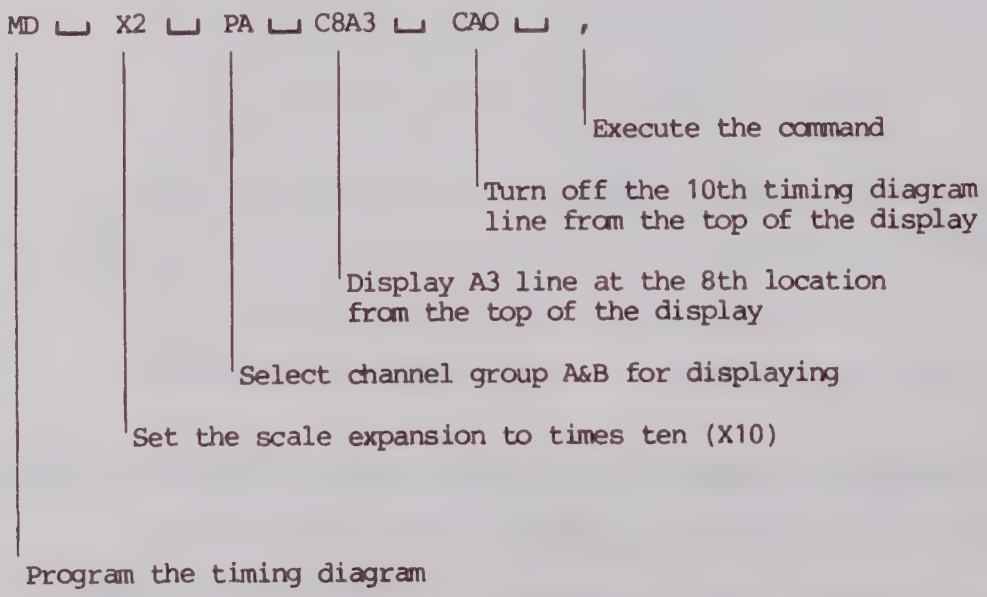
Selects the position in the display for each channel

N1 0 - F hex for the sixteen channel locations in the timing diagram. 0 is the top most and F the bottom most.

N2 A-F/0 channel to be displayed at the N1 position. First Byte or 0 for OFF.

N3 0 - 7 channel to be displayed at the N1 position second byte.

10.4 Timing Diagram Programming Example



11. PROGRAM LIST DISPLAY COMMAND (ML)

A program list menu command is initiated by an (ML) followed by a sequence of character groups separated by single space characters which modify certain parameters in the list display. The command is set into execution by sending one of the execute control characters following the last character in the command sequence. If additional list menu programming is desired before another command type is initiated the ML need not be repeated. Any parameter left unprogrammed by omitting it from the sequence will result in previously programmed or default data left in that field.

11.1 POD select command P (N1N2N3)

Selects data from a selected POD and its format to be added to the list display.

N1 = A thru F for data from PODS A thru F
N2 = + = Positive true data display
- = Negative true data display
O = OFF
N3 = A = ASCII data display
B = Binary data display
H = Hexidecimal data display
O = Octal data display

12. TRANSMISSION MENU (MX)

A transmission menu command is indicated by an MX followed by single space characters which modify certain parameters in the MX menu. This command is executed by sending one of the execute control characters.

12.1 Menu transmission MX (N)

N = R Trace Menu
T Trigger Menu
C Compare Menu
L Data List
F Search Menu

Monitor results in clear text
MX V

NOTE: Compare results only when compare menu is on the display.

12.2 Timing diagram MX D (N)

N = A Pods A + B
C Pods C + D
E Pods E + F

12.3 Specifying the pods for data transmission

MX P (N1 - N6)

N1 - N6 = Pods A - F

S(N) Startaddress

E(N) Endaddress

N = ØØØØ - 1999 (depending to the memory configuration)

Transmit batch file B(N)

N = Ø to 9

12.4 A programming example using the (MX) command to transmit the compare menu out of the LAM 4850A

```
10 DIM AS   500
LAM ADD              TRANSMIT        COMPARE MENU
                                     ASCII MACRO STRING

20 OUTPUT 7,4;"$MX␣C␣,"
30 WAIT 300
40 ENTER 7,4;A$
50 SEND BUS 7;223   REM UNL
60 PRINT A$
70 JF A$  1;3  "END" THEN 40
80 STOP
```

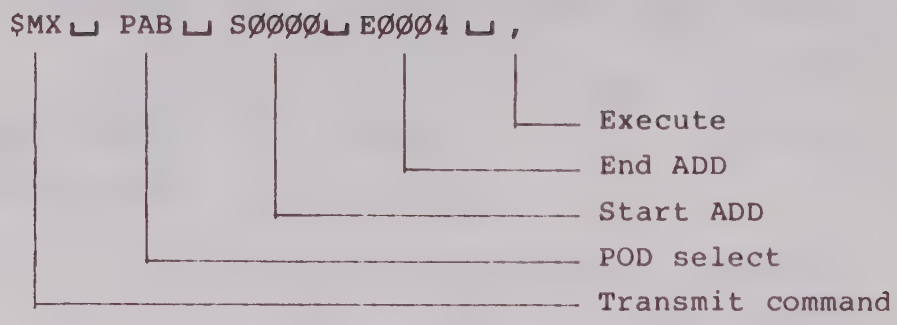
The computer will prompt after running this program with

MC	Compare menu
S0100	Start ADD
E0500	End ADD
PABEF	Compare pods A+B+E+F
09	Compare skew ± 09 samples
B0	Compare mode /BH/Bit
F0	Compare function count if not equal
END	

NOTE: This results only when entered before the following string:

"$MC␣S0100␣E0500␣K09␣B0␣F0␣,"

12.5 EXAMPLE



NOTE

In format 1 (!1) a complete data set of 6k, source or reference memory, could be prepared, in other formats less. A special case is the 4k memory option, there could only be specified one pod or small segments of all pods. The preparation of a complete data set takes approx. 7 seconds.

13. SCRATCH MEMORY CONTROL

Scratch memory control may be selected with an (MS) followed by a sequence of character groups separated by single space characters which cause storage or recall of menus to or from non-volatile RAM. The sequence must be terminated with an execute character (comma or return).

13.1 Scratch storage

Storage to scratch is accomplished with the control sequence:

Store file S (N1N2)
N1 = 1 - 7 File group
N2 = 1 - 6 File number

Scratch file recall R (N1, N2)
N1 = 1 - A File group
N2 = 1 - 6 File number

File group
1 = All states
2 = Trace format
3 = Trigger menu
4 = Compare menu
5 = Timing diagram
6 = Data list
7 = Search word

13.2 EXAMPLE "$MS S42 ,"

Stores compare menu under file number 2
EXAMPLE "MS R36"
Recalls triggermenu with file number 6

14. DISPLAY COMMANDS (MW)

This display command (MW) is used to call up the several displays of the LAM 4850A. A display command is initiated by sending a (MW) followed by the display selector character.
This command is also used to send informations in normal writing to the LA's display (see section 14.2).The command is set into execution by sending one of the execute control characters following the last character in the command sequence.

14.1 Display command MW (N)

N = R trace menu
T trigger menu
C compare menu
L list display
D timing display
V monitor results
B buffer contents

14.2 DISPLAY INFO CODES (only for textwriting on CRT) all 21 lines of the LA's display must be specified, default is ØØ

P (N2 - N21)

Fill N Buffer lines with spaces (20H)

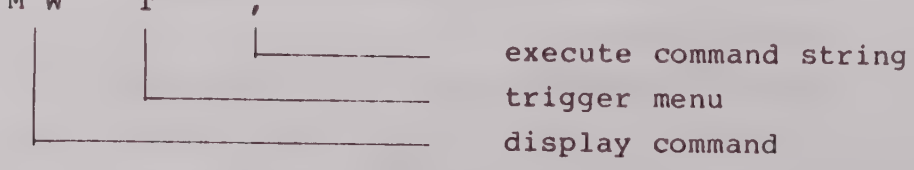
F (N)

N = 01 - 21 line count

Display info per line

00H normal writing
01H blank skip (no blanks out to CRT)
02H skip line in buffer and on CRT
04H blinking line
20H skip line in buffer
40H invert line
80H skip line on CRT

EXAMPLE



15. PROGRAM PRINT CONTROL (MP)

A program print command is initiated by a (MP) followed by a sequence of character groups separated by single space characters. The command is set into execution by sending one of the execute control characters following the last character in the command sequence.

The MP command is used to print out menus and actual data like listing and timing display over the RS 232 port.

15.1 Print screen T (N)

N = R trace menu
T trigger menu
C compare manu

15.2 Print buffer contents B (N)

N = S send

15.3 Print data line L

S (N), E (N) start and end for data line
N = 0000 - 1999 depending on recording format.

15.4 Change data C

Pod specification P ($N_1N_2N_3$)
N_1 = A to F Pod
N_2 = +/- polarity
N_3 = H/B/O/A base HEX/BIN/OCT/ASCII
(see section 15.6)

15.5 Print timing diagram D ($N_1N_2N_3N_4$)

N_1 = A to F Pod
N_2 = 0 - 7 channel
N_3 = S/R source/reference
N_4 = /X noncompare/compare

15.6 An example for the data change command:
"$MP C S0100 ,"

you will get a hard copy

```
             A   B   C   D   E   F
             +   +   +   +   +   +
             HX  HX  HX  HX  HX  HX
Cursor 0100 00  00  00  00  00  00
```

Type in an A the LA will prompt with "=" and now you are able to change the data for pod A at cursor position 100 the LA now shows the next cursor location,to see the previous location type in a "^".

This mode can be left by typing a period.

16. SEARCH FUNCTION PROGRAMMING COMMAND

A search function command is initiated by an (MF) followed by a sequence of character groups separated by single space characters which modify certain parameters in the search mode. The command is set into execution by sending one of the execute control characters following the last character in the command sequence. If additional search mode programming is desired before another command type is initiated the MF need not be repeated.

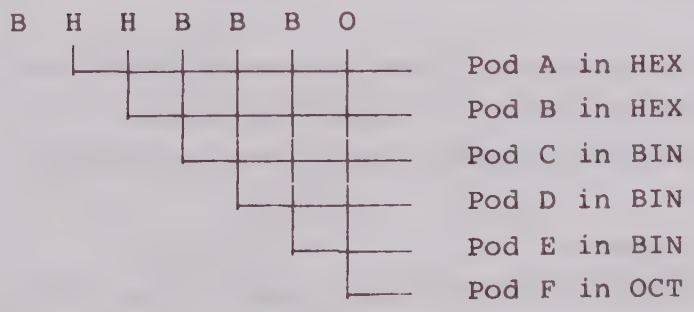
16.1 Function select D (N)

N = E/U/S E = search for equality
U = search for unequality
S = sequence

16.2 Base for search combination B (N1 - N6)

N1 - N6 = B for Binary
H for Hex
O for Octal

EXAMPLE



The B command prepairs the sequential search word definition base.

16.3 Amount of sequence levels C (N)

N = Ø1 - 12 = sequence number

16.4 Search combination P (N combination)

N = A - F = define the Pod from A - F

Combination = a 8 digit word in pos. binary.

16.5 Sequence length L(N)

N = Ø1 - 12

16.6 Search mode (advance search) A (N)

N = N/E

N = next event

E = next edge

The search results will be prepared in the transmit buffer after each execution with the following format:

E = XXXX = search event counter
T = XXXX = search total counter
C = XXXX = actual cursor position
and can be read out with MP BS command

17. BATCH MENU (MB) BATCH FILE HANDLING

The LAM 4850A gives to the user the capability to store and execute up to ten batch files each 350 bytes long. The batch files may be used to work high effective with often repeated test setups.

Programming rules for batch files are:
Programming a batch file starts with N where N is a number between Ø - 9, the terminator is a

17.1 EXAMPLE

Remains batch file number 1 as trace menu programming in 32 bit mode, MAN start, internal clock rate 500ms, trigger delay 500 sample clocks.

1 MR S0 G1 F22 D500

Executing batch files has the following format

MB F(N1N2)

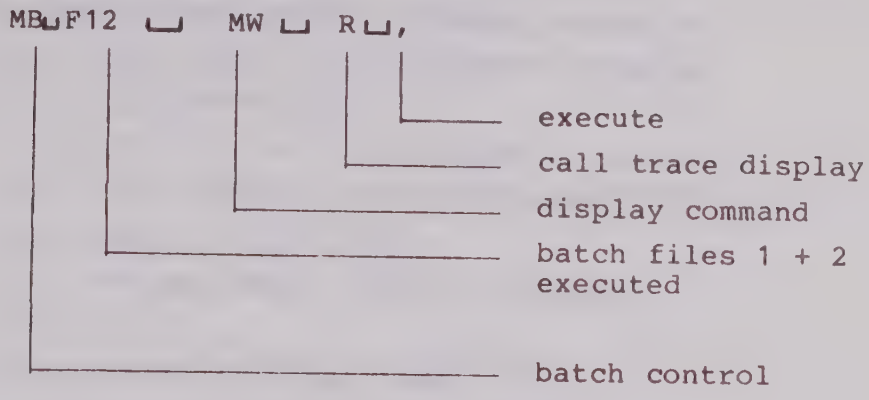
N_1 = 0 - 9 first file to be executed

N_2 = 0 - 9 last file to be executed

NOTE:

After executing a batch file with the MB command, a "M..." command like MW (N) must follow.

EXAMPLE



IMPORTANT

Nested batch files are not allowed. The batch file area will be cleared by power up and reset "*".

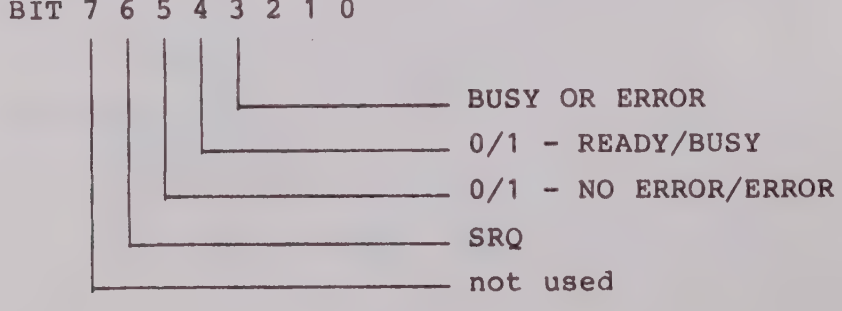
18. DISPLAY STATUS INFORMATION

To get informations about what the analyzer is actually doing the user has to use the seriell poll routine to read the LA's status byte.

A typical example for the seriell poll is the following program example

```
10 DIM S (500)
20 Sendbus 7;223,191,152,196

    Device ADD        SPE  MTA

              Unt.  Unl


30 Wait 300 Device Add  LA  Add

40 S = READBIN (704)

50 Sendbus 7;191,25

           Unl   SPD

60 PRINT S
    S   is the status byte
```

18.1 Status byte



18.2 Error codes

BIT 3210

0000 BATCH FILE OVERFLOW
0001 PARAMETER OUT OF RANGE (RNGERR)
0010 INVALID FUNCTION IN TRIGGER MENU
0011 DATA TRANSMISSION ERROR
0100 SYNTAX ERROR (SYXER)
0101 GPIB COMMAND ERROR
0110 INVALID PARAMETER (IVPAR)
0111 INVALID TRIGGER FUNCTION ASSIGNMENT (ITRIF)
1000 COMMAND BUFFER FULL
1001 INVALID MENU (IVMEN)
1010 N.U.
1011 INVALID TRIGGER DELAY CLOCK
1100 NO OPTION AVAILABLE (NOPTAV)
1101 N.U.
1110 NONVOLATILE MEMORY ERROR (NOVMER)
1111 SETUP IN ERROR (SETER)

18.3 Busy codes

BIT 3210

0000 INTERPRETER ACTIVE
0001 DATA BLOCK PREP IN PROGRESS
0010 MENU INFO PREP IN PROGRESS
0011 L.A. BUSY EXECUTING KEYBOARD COMMAND
0100 SEARCH ACTIVE
0101 PRINT ACTIVE
0110 COMPARE MENU ACTIVE
0111 TRIGGER DELAY ACTIVE
1000 SEARCHING FOR TRIGGER
1001 PRETRIGGER DATA SAMPLING
1010 SLOW CLOCK
1011 N.U.
1100 N.U.
1101 N.U.
1110 N.U.
1111 N.U.

19. MONITOR RESULTS MV

This command is used to get the monitor informations, the results will be prepared in the transmit buffer.

19.1 MV (N)

N = S Setup results in coded information

N = C Compare results in coded information

19.2 Code information

Bit description

Setup

2^7 Compare setup in error

2^6 N.U.

2^5 N.U.

2^4 N.U.

2^3 N.U.

2^2 Triggerword sample clock has to be assigned to an active pod group

2^1 Pod skew trigger delay (neg. trigger delay)

2^0 All pods off

19.3 Compare

Bit description

2^7 N.U.

2^6 end address and skew end of menu

2^5 start address - skew memory

2^4 start address end address

2^3 data format mismatch

2^2 all selected pods disabled

2^1 N.U.

2^0 N.U.

20. CURSOR MENU MH

This command is used to move the cursor in the timing display and the data list, and has the following format

20.1 MH C(N)

N = 4 digit decimal address

Baud rate selection for the serial interface

20.2 B (N)

N = 0 - 1 Code for baud rate

0 = 110 baud

1 = 300 baud

for further expansion

2 = 600 baud

3 = 1200 baud

4 = 2400 baud

5 = 4800 baud

6 = 9600 baud

20. CURSOR MENU MH

This command is used to move the cursor in the timing display and the data list, and has the following format

20.1 MH C(N)

N = 4 digit decimal address

Baud rate selection for the serial interface

20.2 B (N)

N = 0 - 1 Code for baud rate

0 = 110 baud

1 = 300 baud

for further expansion

2 = 600 baud

3 = 1200 baud

4 = 2400 baud

5 = 4800 baud

6 = 9600 baud

Service Information

4850 A SERVICE MANUEL INDEX

ALP 44															ORG. FORMAT				MAN	
5 9000-01	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC					X													1		1
ASSY DRWG					X															
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

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ECL-COMPARATOR															ORG. FORMAT				MAN	
U 11079-01	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC	X																	1		1
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

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INPUT BOARD															ORG. FORMAT				MAN	
5 4851-01A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC					X											1		1	1	1
ASSY DRWG					X															
PINOUTS																				
BLOCKDIAGRAM																				

TIME BASE															ORG. FORMAT				MAN	
5 4851-02A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC						X									1		1		2	
ASSY DRWG						X														
PINOUTS																				
BLOCKDIAGRAM																				

KEYBOARD															ORG. FORMAT				MAN	
5 4851-03A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC		X															1		1	
ASSY DRWG		X																		
PINOUTS																				
BLOCKDIAGRAM																				

MOTHER BOARD															ORG. FORMAT				MAN	
5 4851-04A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC					X										2			1	2	1
ASSY DRWG					X															
PINOUTS																				
BLOCKDIAGRAM																				

CPU BOARD															ORG. FORMAT				MAN	
5 4851-05A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC			X													1		1	1	1
ASSY DRWG			X																	
PINOUTS																				
BLOCKDIAGRAM																				

CHARACTER BOARD															ORG. FORMAT				MAN	
5 4851-07A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC				X											1			1	1	1
ASSY DRWG				X																
PINOUTS																				
BLOCKDIAGRAM																				

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RASTER COUNTER															ORG. FORMAT				MAN	
5 4851-08A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC								X								1	1		2	
ASSY DRWG								X												
PINOUTS																				
BLOCKDIAGRAM																				

CONTROL BOARD															ORG. FORMAT				MAN	
5 4851-09A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC			X													2	1		3	
ASSY DRWG			X																	
PINOUTS																				
BLOCKDIAGRAM																				

MEMORY BOARD 2															ORG. FORMAT				MAN	
5 4851-14 A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC		X														1			1	
ASSY DRWG		X																		
PINOUTS																				
BLOCKDIAGRAM																				

MEMORY BOARD 1															ORG. FORMAT				MAN	
5 3250-06A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC	X															1		1	1	1
ASSY DRWG	X																			
PINOUTS																				
BLOCKDIAGRAM																				

SBLA															ORG. FORMAT				MAN	
5 4850-06A4	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC												X				1	1		2	
ASSY DRWG												X								
PINOUTS																				
BLOCKDIAGRAM																				

GPIB/THRESHOLD BOARD															ORG. FORMAT				MAN	
5 4850-08	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC								X									3		3	
ASSY DRWG								X												
PINOUTS																				
BLOCKDIAGRAM																				

4850 A SERVICE MANUEL INDEX

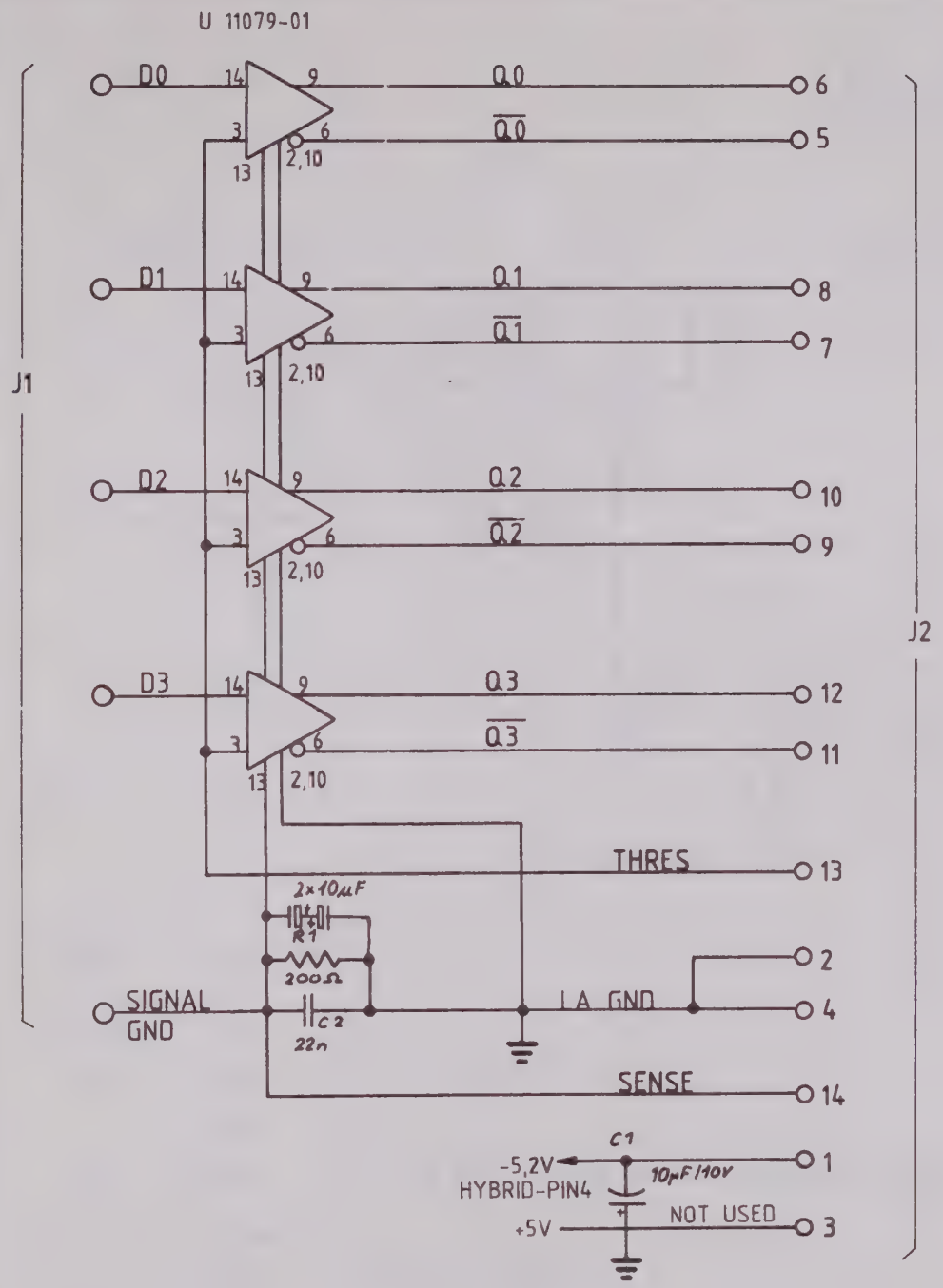
TRIGGER BOARD															ORG. FORMAT				MAN	
5 4850-10A2	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC												X				2	1		3	
ASSY DRWG												X								
PINOUTS																				
BLOCKDIAGRAM																				

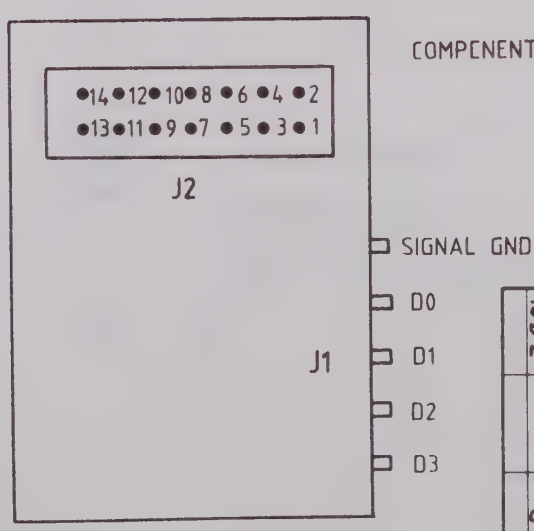
															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				

															ORG. FORMAT				MAN	
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	A1	A2	A3	A4	A3	A4
SCHEMATIC																				
ASSY DRWG																				
PINOUTS																				
BLOCKDIAGRAM																				



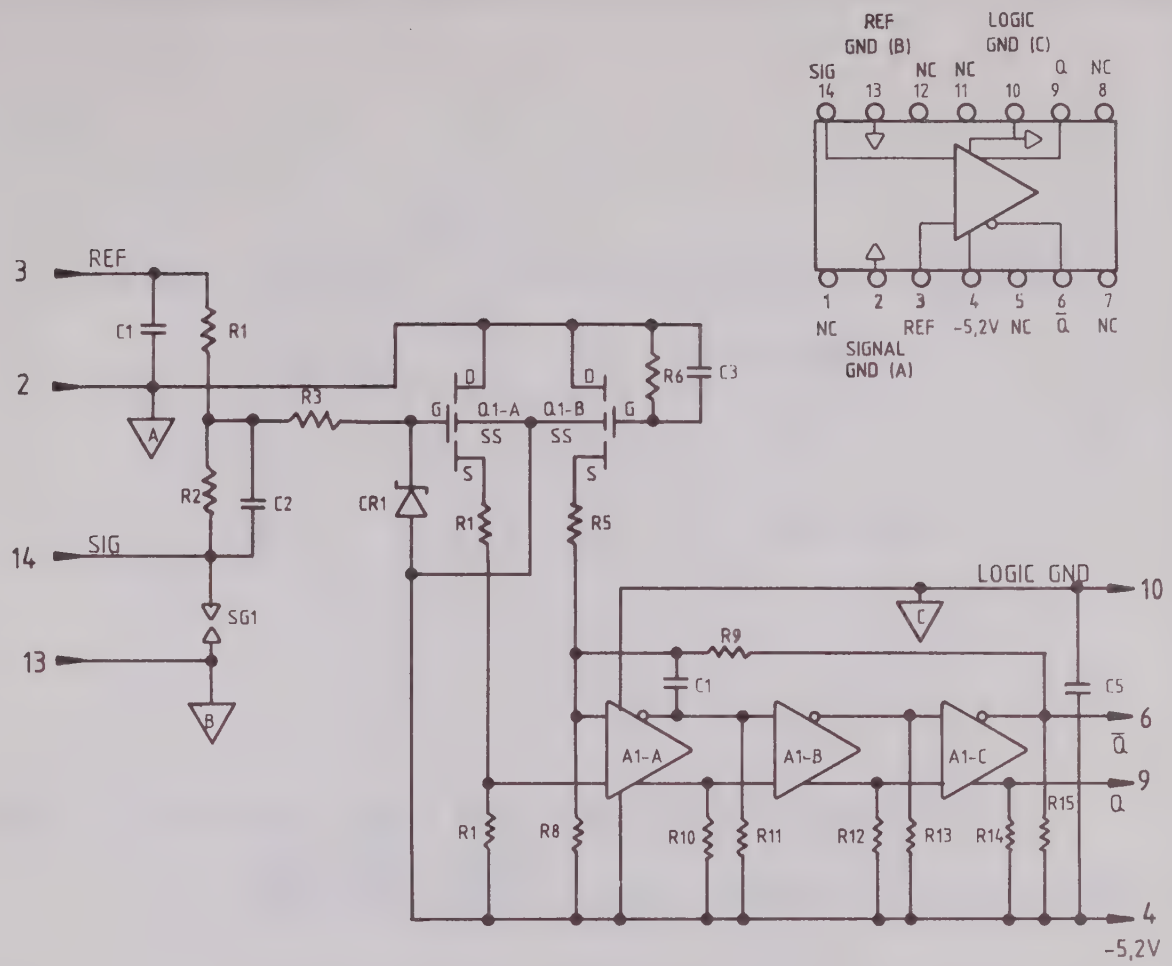


D	3.9.81	CODE	ERN	DATE	REVISIONS	
B	20.3.81					
					NAME	
					DATE	
					CHECK	
					DRAWN	20.3.81

DOLCH LOGIC INSTRUMENTS

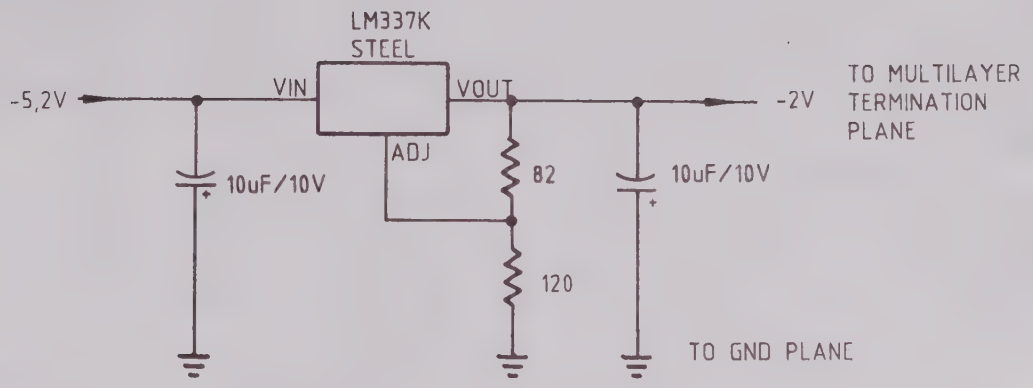
ALP 44 BOARD

PART NUMBER	SHEET
5 9000-01	1/1



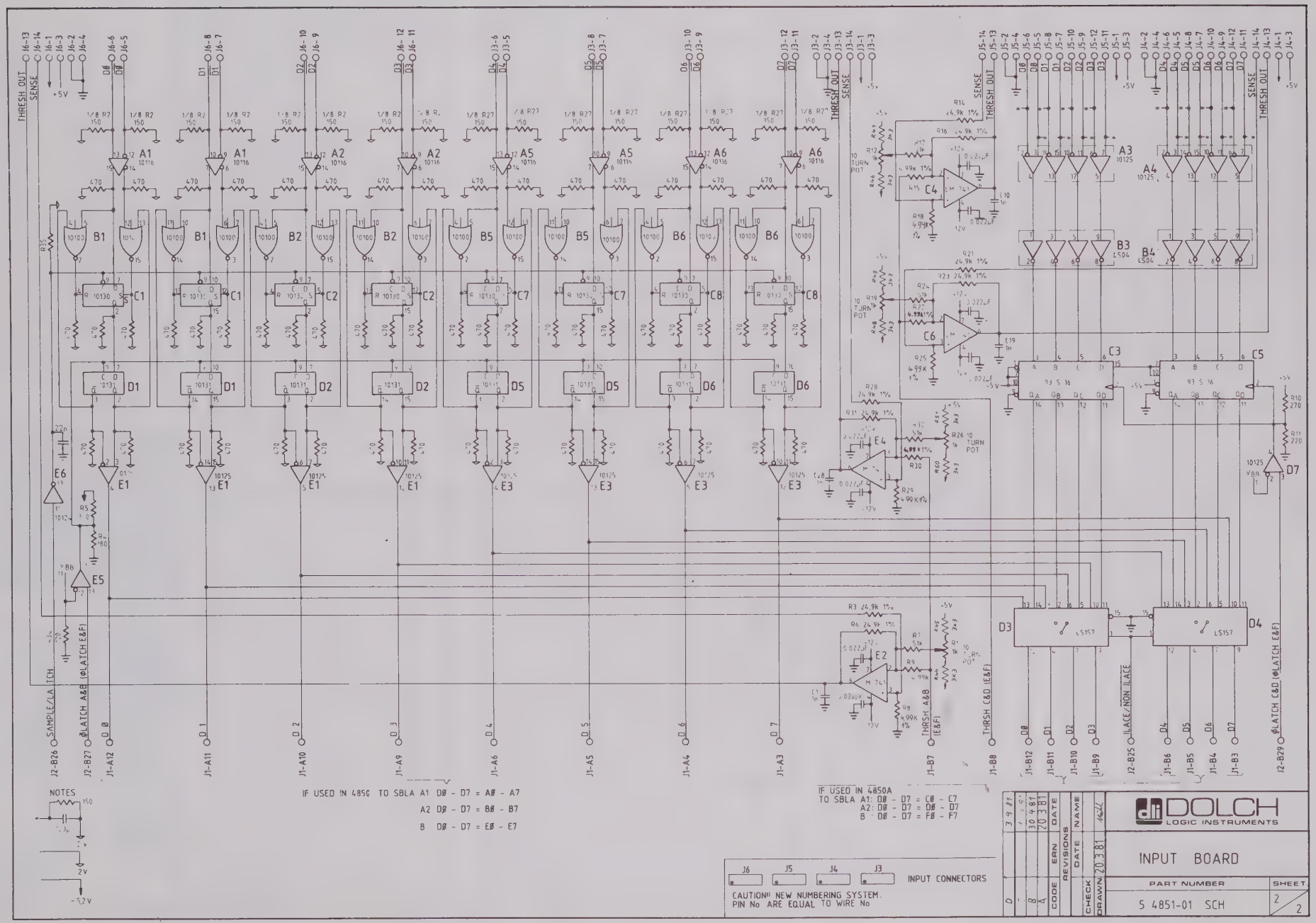
R1,2	500K	1% P.T.
R3,4,5	100	
R6	250K	2%
	470	5%
R9	4K	4-4.5K SELECT FOR 20mV HYSTERESIS R1,8-1K
C1	100pF	
C2	4pF	SELECT 3.9-4.7
C3,C5	01uF	
C4	2.7pF	
CR1	HP5082-0024	
Q1	SPI 5001G	SELECTED DMOS
A		MCL10206-2 ECL
CASE		DIC TOOL CO. MEADEVILLE PA D1-14-01
SG-1	100	

		20.3.81	DATE	REVISIONS	NAME		DOLCH LOGIC INSTRUMENTS
		ERN			DATE	20.3.81	INPUT COMPARATOR, HYBRID
	A	CODE			CHECK	DRAWN	PART NUMBER: U 11079-01 — SHEET 1/1



NOTES: 1. REVISION A AND B DONT HAVE A GND PLANE AND THE -2V TERMINATION PLANE.
ALL TERMINATION RESISTORS ARE CONNECTED TO -5,2 VOLTS.

								DOLCH LOGIC INSTRUMENTS
		7.9.81	DATE		NAME			INPUT BOARD
			ERN	REVISIONS	DATE	CHECK	DRAWN 7.9.81	PART NUMBER: 5 4851-01 SCH
		D	CODE					SHEET: 1/2



THRESH OUT
SENSE
SAMPLE/LATCH
ØLATCH A&B (ØLATCH E&F)
THRSH A&B (E&F)
THRSH C&D (E&F)
ILACE/NON ILACE
ØLATCH C&D (ØLATCH E&F)
NOTES
IF USED IN 4850 TO SBLA A1 DØ - D7 = AØ - A7
A2 DØ - D7 = BØ - B7
B DØ - D7 = EØ - E7
IF USED IN 4850A
TO SBLA A1: DØ - D7 = CØ - C7
A2: DØ - D7 = DØ - D7
B DØ - D7 = FØ - F7
INPUT CONNECTORS
CAUTION!! NEW NUMBERING SYSTEM.
PIN No ARE EQUAL TO WIRE No
DOLCH
LOGIC INSTRUMENTS
INPUT BOARD
PART NUMBER
5 4851-01 SCH
SHEET
2/2

POS	ITEM	DLI - PART - NO	QT
	LS 04		2
	S 157		2
	LM 741		4
	93 S 16		2
	10 100		4
	10 116		5
	10 124		1
	10 125		5
	10 130		4
	10 131		4
	LM 337 K / LM 337 T		1
R 53	82 Ω		1
R 44...51	3K3		8
R 52,34	120 Ω		2
R 4	180 Ω		1
R 11	220 Ω		1
R 10	270 Ω		1
R 5	300 Ω		1
R 35	470 Ω		1
R 8, 18, 25, 29	4K99 1%		4
R 7, 17, 24, 32	51K		4
R 9, 15, 22, 30	4k99 1%		4
R 3, 6, 14, 16 21, 23 28, 31	24k9 1%		*8
*	SIL 4 x 1k		4
R 2, 13 20, 27	37,39 SIL 8 x 150 Ω		6
R 36, 38 40...43	SIL 8 x 470 Ω		6
R 1, 12, 19, 26	R - Trimmer 1K		4

alle Widerstände haben RM : 10,16 mm !
R 52, 53 haben RM : 12,7 mm !

* von unten bestücken

CODE	ERN	DATE	NAME
	REVISIONS		
	DATE		
CHECK			
DRAWN	8.10.81	Gehrke	

DOLCH LOGIC INSTRUMENTS

PART LIST

INPUT BOARD Rev. E

PART NUMBER 54851 - Ø1A1

SHEET 1/2

POS	ITEM	DLI - PART - NO	QT
C1, 10, 19, 28	1nF		4
C2 ... 9 29 -- 36	nicht bestücken		
C 11 ... 18 20 ... 27	82p		16
ϕ	10µF/35V		8
⊥	22n		24
	14 p. Wire Wrap. Leisten		4
	Sockel 8p.		4
	Sockel 14p.		2
	Sockel 16 p.		27

A1 → INPUT A+C/B+D

CODE	ERN	REVISIONS	DATE	NAME
			CHECK	
			DRAWN	8.10.81 Gehrke

DOLCH LOGIC INSTRUMENTS

PART LIST

INPUT BOARD Rev. E

PART NUMBER: 5 4851-Ø1A1

SHEET: 2/2

POS	ITEM	DLI - PART - NO	QT
	LS 04		2
	S 157		2
	LM 741		4
	93 S 16		2
	10 100		4
	10 116		5
	10 124		1
	10 125		5
	10 130		4
	10 131		4
	LM 337 K / LM 337 T		1
R 53	82 Ω		1
R 44 - 51	3K3		8
R 52, 34	120 Ω		2
R 4	180 Ω		1
R 11	220 Ω		1
R 10	270 Ω		1
R 5	300 Ω		1
R 35	470 Ω		1
R 8, 18, 25, 29	4K99 1%		4
R 7, 17, 24, 32	51K		4
R 9, 15, 22, 30	4k99 1%		4
R 3, 6, 14, 16 21, 23 28, 31	24k9 1%		*8
*	SIL 4 x 1k		4
R 2, 13 20, 27	37,39 SIL 8 x 150 Ω		6
R 36, 38 40 ... 43	SIL 8 x 470 Ω		6
R 1, 12, 19, 26	R - Trimmer 1K		4

alle Widerstände haben RM : 10,16 mm !
R 52, 53 haben RM : 12,7 mm !

* von unten bestücken

CODE	ERN	DATE
	REVISIONS	
	DATE	NAME
CHECK		
DRAWN	8.10.81	Gehrke

DOLCH
LOGIC INSTRUMENTS

PART LIST

INPUT BOARD Rev. E

PART NUMBER 54851 - Ø1A2

SHEET 1/2

C1, 10, 19, 28	1nF		4
C2 ... 9 29-36	47p		16
C 11...18 20...27	82p		16
ϕ	10µF/35V		8
⊥	22n		24
	14 p. Wire Wrap. Leisten		4
	Sockel 8p.		4
	Sockel 14p.		2
	Sockel 16 p.		27

A2 → INPUT E+F

CODE	ERN	DATE	NAME
	REVISIONS		
	DATE		
	CHECK		
	DRAWN	8.10.81	Gehrke

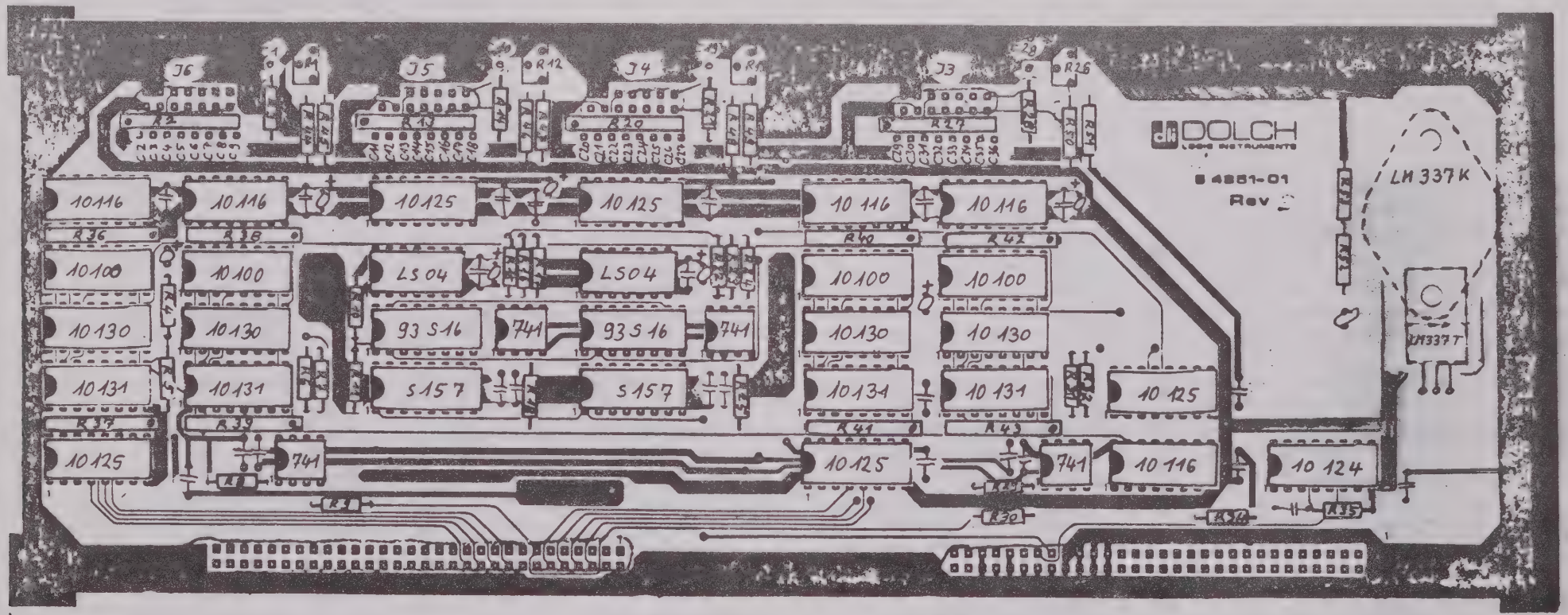
DOLCH
LOGIC INSTRUMENTS

PART LIST

INPUT BOARD Rev. E

PART NUMBER: 5 4851-01A2

SHEET 2/2



alle Widerstände haben RM: 10,16 mm !

R 52, 53 haben RM: 12,7 mm !

A 1 → A+C/B+D
A 2 → E+F

							DOLCH LOGIC INSTRUMENTS
							ASS'Y DRAWING
							INPUT BOARD Rev. E
							PART NUMBER / SHEET
CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN 8.10.81 Fehrke

J1 A		J1 B
+5V	1	+5V
+5V	2	+5V
DI"C 7 OR DI"D 7	3	DI"A 7 OR DI"B 7
DI"C 6 OR DI"D 6	4	DI"A 6 OR DI"B 6
DI"C 5 OR DI"D 5	5	DI"A 5 OR DI"B 5
DI"C 4 OR DI"D 4	6	DI"A 4 OR DI"B 4
	7	THRS A OR THRS B
	8	THRS C+D
DI"C 3 OR DI"D 3	9	DI"A 3 OR DI"B 3
DI"C 2 OR DI"D 2	10	DI"A 2 OR DI"B 2
DI"C 1 OR DI"D 1	11	DI"A 1 OR DI"B 1
DI"C 0 OR DI"D 0	12	DI"A 0 OR DI"B 0
BRDS1	13	THRS C+Q
-12V	14	-12V
-12V	15	-12V
+12V	16	+12V
+12V	17	+12V
C7=$\overline{\text{MRKLD}}$	18	C6=$\overline{\text{CACKN}}$
C5=$\overline{\text{CRDY}}$	19	C4=$\overline{\text{CHAR RD}}$
C3=$\overline{\text{ACKN}}$	20	C2=$\overline{\text{I/O-WR}}$
C1=$\overline{\text{DATA RDY}}$	21	C0=$\overline{\text{I/O-RD}}$
A1	22	A0
A3	23	A2
A5	24	A4
A7	25	A6
D7	26	D6
D5	27	D4
D3	28	D2
D1	29	D0
	30	
GND	31	GND
GND	32	GND

J2 A		J2 B
GND	1	GND
GND	2	GND
	3	
	4	
	5	
	6	
Ø REC A2	7	
	8	
Ø REC A1	9	LCLK
	10	
	11	
	12	
	13	
	14	TL 0
	15	TL 1
	16	
	17	
	18	TOUAL
	19	TGLD
	20	$\overline{\text{TGRES}}$
	21	
	22	
	23	
	24	
	25	ILACE/$\overline{\text{NON ILACE}}$ *
	26	SAMPLE/$\overline{\text{LATCH}}$
	27	Ø LATCH A1(ECL)
	28	
	29	Ø LATCH A2(ECL)
	30	
+5V	31	+5V
+5V	32	+5V

J3, J4, J5, J6 = ALP 44 CONNECTOR

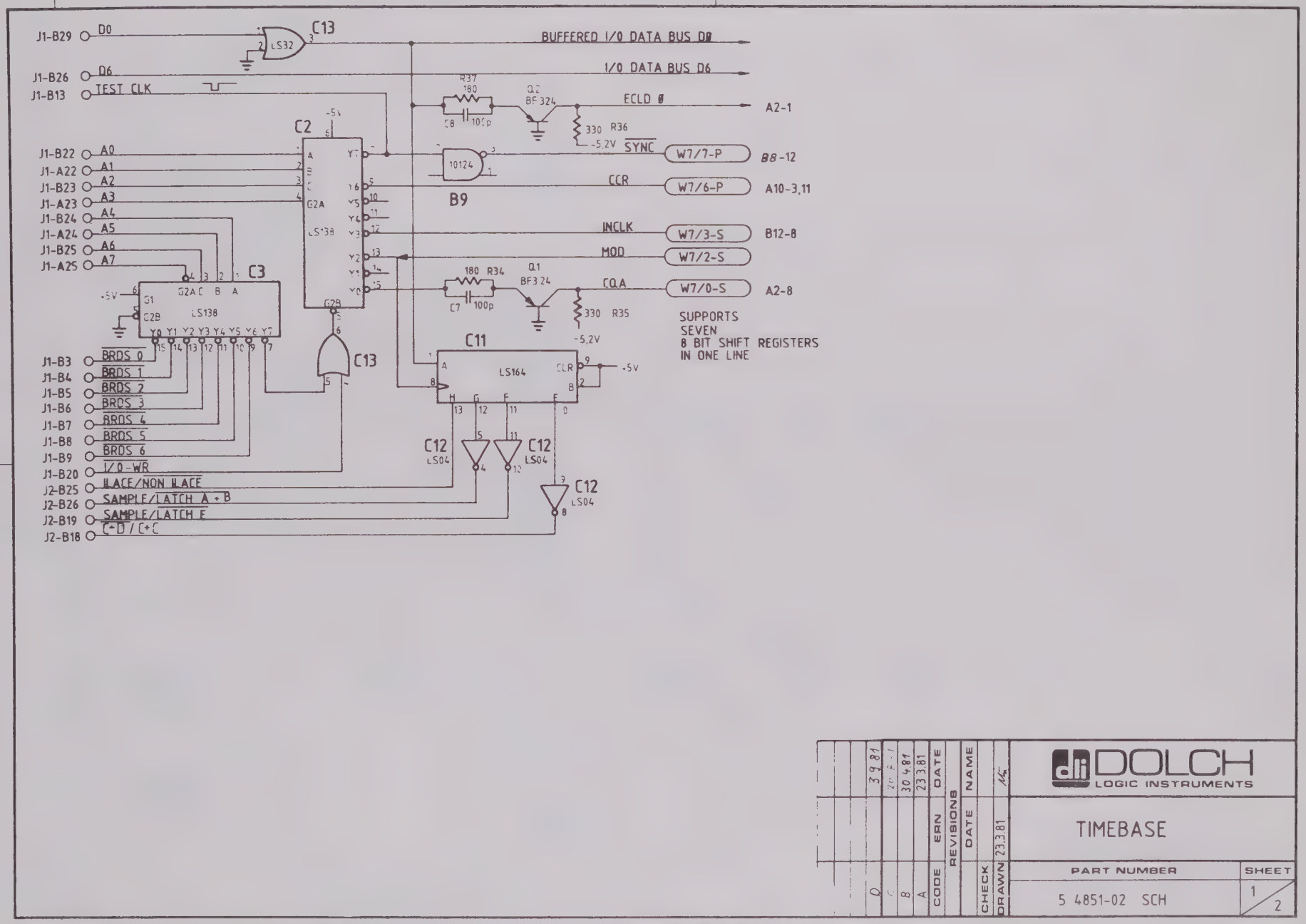
* FOR INPUT BRD E&F: C+D / C+C

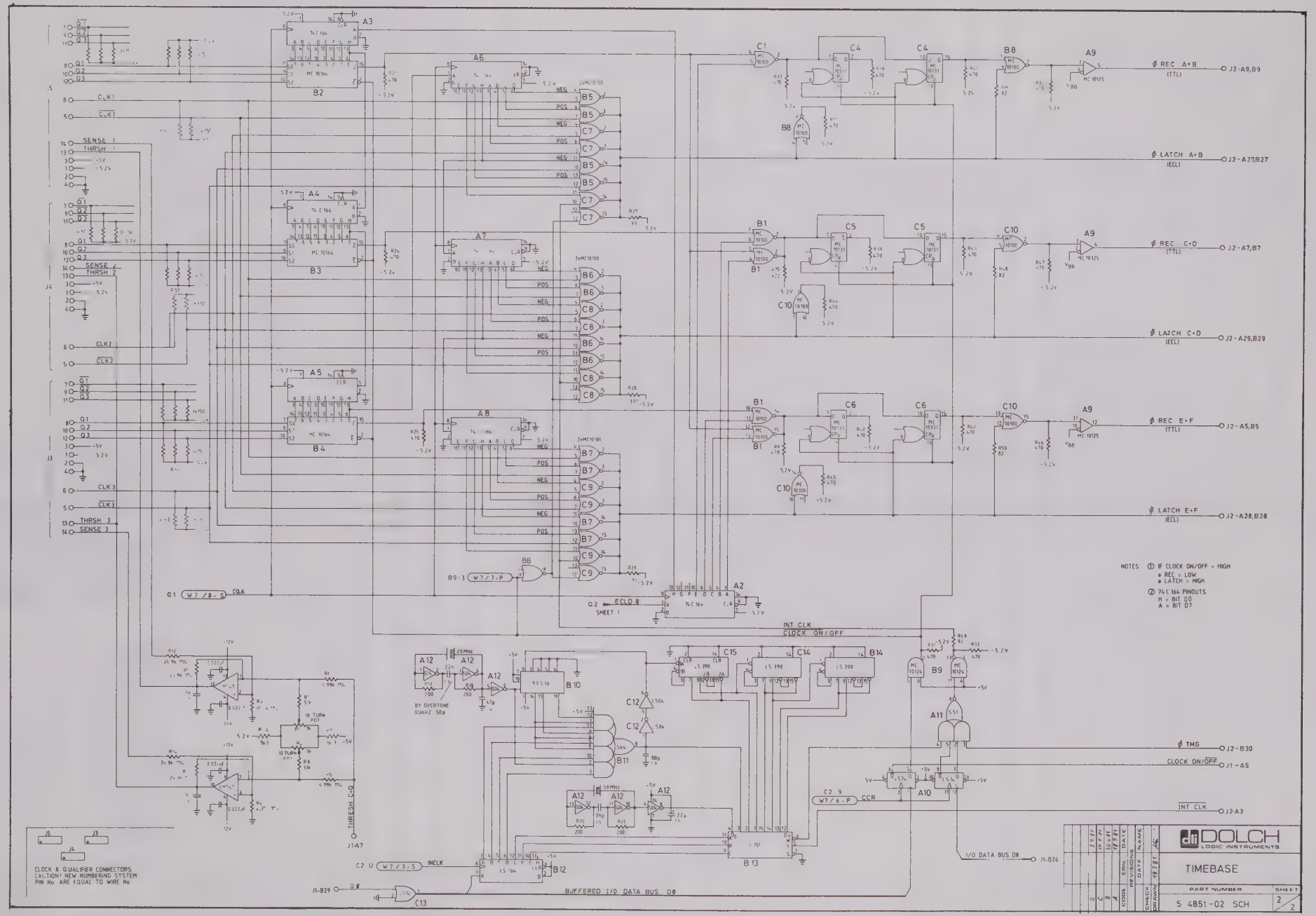
CODE	ERN	DATE	
REVISIONS		NAME	
		DATE	
CHECK			
DRAWN		21.12.81	

DOLCH LOGIC INSTRUMENTS

INPUT BOARD

PART NUMBER	SHEET
5.4851 - 01	1/1


J1-B29 D0
J1-B26 D6
J1-B13 TEST CLK
J1-B22 A0
J1-A22 A1
J1-B23 A2
J1-A23 A3
J1-B24 A4
J1-A24 A5
J1-B25 A6
J1-A25 A7
J1-B3 BRDS 0
J1-B4 BRDS 1
J1-B5 BRDS 2
J1-B6 BRDS 3
J1-B7 BRDS 4
J1-B8 BRDS 5
J1-B9 BRDS 6
J1-B20 I/O-WR
J2-B25 ILACE/NON ILACE
J2-B26 SAMPLE/LATCH A+B
J2-B19 SAMPLE/LATCH E
J2-B18 C+D / C+C
C13
LS32
C2
LS138
C3
LS138
C13
C11
LS164
C12
LS04
C12
LS04
C12
LS04
BUFFERED I/O DATA BUS D0
I/O DATA BUS D6
R37
180
C8
100p
Q2
BF324
ECLD 0
A2-1
330 R36
-5,2V
SYNC
W7/7-P
B8-12
10124
B9
CCR
W7/6-P
A10-3,11
INCLK
W7/3-S
B12-8
MOD
W7/2-S
180 R34
C7
100p
Q1
BF324
CQA
W7/0-S
A2-8
330 R35
-5,2V
SUPPORTS
SEVEN
8 BIT SHIFT REGISTERS
IN ONE LINE
+5V
DOLCH
LOGIC INSTRUMENTS
TIMEBASE
PART NUMBER
5 4851-02 SCH
SHEET
1/2
CODE
ERN
DATE
REVISIONS
DATE
NAME
CHECK
DRAWN
23.3.81
D
C
B
A
3.9.81
30.4.81
23.3.81


SENSE 1
THRSH 1
CLK1
SENSE 2
THRSH 2
CLK2
CLK3
THRSH 3
SENSE 3
A1
A2
A3
A4
A5
A6
A7
A8
A9
A10
A11
A12
B1
B2
B3
B4
B5
B6
B7
B8
B9
B10
B11
B12
B13
B14
C1
C2
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
Q1 W7/8-S CQA
Q2 ECLD 0
SHEET 1
B9-3 W7/7-P
C2 9 W7/6-P CCR
C2 12 W7/3-S INCLK
INT CLK
CLOCK ON/OFF
φ REC A+B (TTL)
φ LATCH A+B (ECL)
φ REC C+D (TTL)
φ LATCH C+D (ECL)
φ REC E+F (TTL)
φ LATCH E+F (ECL)
φ TMG
CLOCK ON/OFF
INT CLK
J2-A9,B9
J2-A27,B27
J2-A7,B7
J2-A29,B29
J2-A5,B5
J2-A28,B28
J2-B30
J1-A5
J2-A3
I/O DATA BUS D8
J1-B26
J1-B29
BUFFERED I/O DATA BUS D8
THRESH C-Q
J1-A7
20MHz
50MHz
BY OVERTONE QUARZ 50p
10 TURN POT
NOTES ① IF CLOCK ON/OFF = HIGH
= REC = LOW
= LATCH = HIGH
② 74 C 164 PINOUTS
H = BIT 00
A = BIT 07
CLOCK & QUALIFIER CONNECTORS
CAUTION! NEW NUMBERING SYSTEM
PIN No ARE EQUAL TO WIRE No
DOLCH
LOGIC INSTRUMENTS
TIMEBASE
PART NUMBER
5 4851-02 SCH
SHEET
2/2

POS	ITEM	DLI - PART - NO	QT
	LS 04		1
	LS 32		1
	LS 74		1
	LS 138		2
	LS 164		2
	LS 390		3
	S 04		1
	S 51		1
	S 64		1
	S 151		1
	93S 16		1
	LM 747		1
	74 C 164		7
	10 100		10
	10 124		1
	10 125		1
	10 131		3
	10 164		3
R29···29	390 Ω		3
R16, 48, 49, 50	82 Ω		4
R 34, 37	180Ω		2
R 18···21	200Ω		4
R 35, 36	330Ω		2
R 9, 17 30···33, 38-47 22-26	470 Ω		21
R 3, 4	4k99 1%		2
R 7, 8	51K		2

CODE	ERN	REVISIONS	DATE	NAME

CHECK
DRAWN 2.12.81 Gewrle

DOLCH
LOGIC INSTRUMENTS

PART LIST

TIME BASE BOARD Rev. F

PART NUMBER	SHEET
5 4851 - Ø2	1/2

POS	ITEM	DLI - PART - NO	QT
R 54,55	3k3		2
R 5,6	4k99 1%		2
R 12…15	24k9 1%		4
R 51…53	SIL 8 x 150Ω		3
R 1,2	R-Trimmer 1k		2
Q 1,2	BF 397 / BF 324		2
Y 1	Quartz 20MHz		1
Y 2	Quartz 50MHz		1
C 6	27 pF		1
C 4	47pF		1
C 7,8,9	100pF		3
C 1,2	1nF		2
C 5	22 µF/6V		1
C 3 ⏚	22n		22
⌀	10µF/35V		10
	14 p. Wire Wrap Leisten (gerade)		3
	Sockel 14 p.		16
	Sockel 16 p.		25

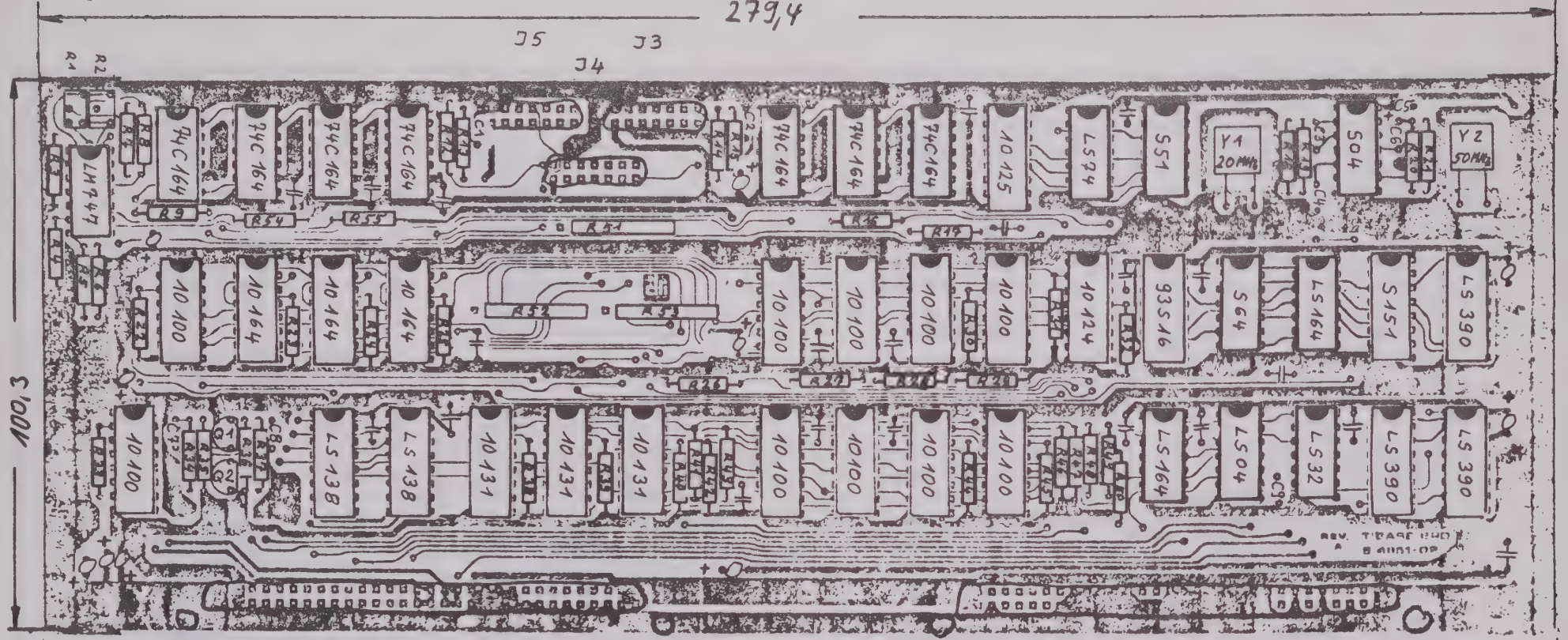
CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	2.12.81	Gehrke

DOLCH LOGIC INSTRUMENTS

PART LIST
TIME BASE BOARD Rev. F

PART NUMBER: 5 4851 - Ø2

SHEET: 2/2



CODE	ERN	DATE	REVISIONS	DATE	NAME	
				CHECK	DRAWN 8.12.84	Colwke

DOLCH
LOGIC INSTRUMENTS

ASS'Y DRAWING

TIME BASE BOARD Rev. F

PART NUMBER	SHEET
5 4851 - Ø2 A	

J1

A		B
+5V	1	+5V
+5V	2	+5V
	3	$\overline{\text{BRDS 0}}$
	4	$\overline{\text{BRDS 1}}$
	5	$\overline{\text{BRDS 2}}$
	6	$\overline{\text{BRDS 3}}$
THRS C+Q	7	$\overline{\text{BRDS 4}}$
	8	$\overline{\text{BRDS 5}}$
	9	$\overline{\text{BRDS 6}}$
	10	
	11	
	12	
	13	TEST CLK
-12V	14	-12V
-12V	15	-12V
+12V	16	+12V
+12V	17	+12V
C7=$\overline{\text{MRKLD}}$	18	C6=$\overline{\text{CACKN}}$
C5=$\overline{\text{CRDY}}$	19	C4=$\overline{\text{CHAR RD}}$
C3=$\overline{\text{ACKN}}$	20	C2=$\overline{\text{I/O-WR}}$
C1=$\overline{\text{DATA RDY}}$	21	C0=$\overline{\text{I/O-RD}}$
A1	22	A0
A3	23	A2
A5	24	A4
A7	25	A6
D7	26	D6
D5	27	D4
D3	28	D2
D1	29	D0
	30	
GND	31	GND
GND	32	GND

J2

A		B
GND	1	GND
GND	2	GND
	3	
	4	
Ø REC B	5	Ø REC B
	6	
Ø REC A2	7	Ø REC A2
	8	
Ø REC A1	9	Ø REC A1
	10	
	11	
	12	
	13	
	14	
	15	
	16	
	17	
	18	$\overline{\text{C+D}}$ / C+C
	19	SAMPLE / LATCH E
	20	
	21	
	22	
	23	
	24	
	25	ILACE/$\overline{\text{NON ILACE}}$
	26	SAMPLE/$\overline{\text{LATCH A+B}}$
Ø LATCH A1(ECL)	27	Ø LATCH A1(ECL)
Ø LATCH B(ECL)	28	Ø LATCH B(ECL)
Ø LATCH A2(ECL)	29	Ø LATCH A2(ECL)
	30	Ø TMG
+5V	31	+5V
+5V	32	+5V

J3, J4, J5 = ALP 44 CONNECTOR

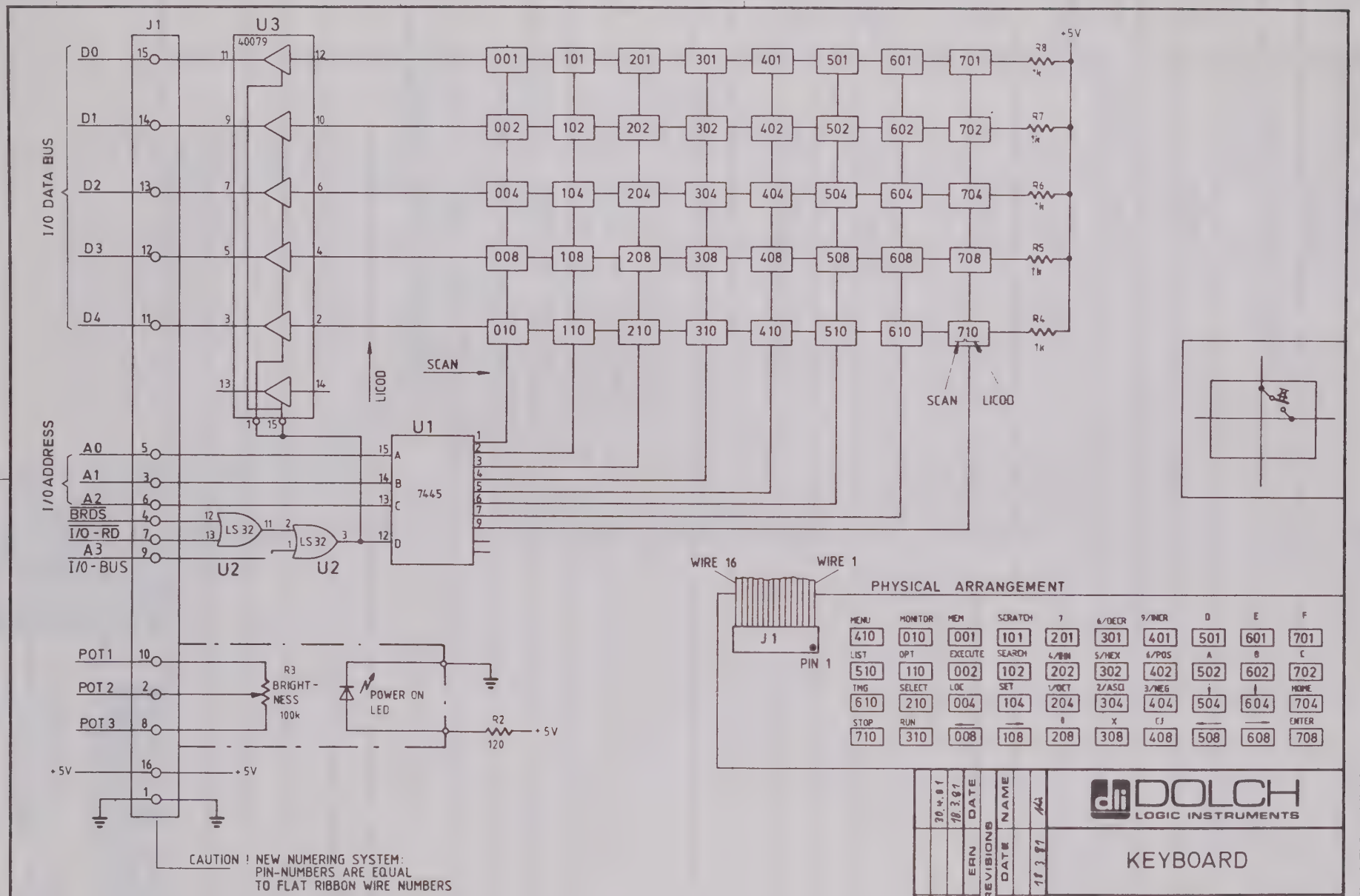
DOLCH LOGIC INSTRUMENTS

TIMEBASE

CODE	ERN	REVISIONS	DATE	NAME	DATE
				CHECK	
				DRAWN	21.12.81

PART NUMBER 5 4851 - 02

SHEET 1/2


J1
U3
40079
D0
D1
D2
D3
D4
I/O DATA BUS
I/O ADDRESS
A0
A1
A2
BRDS
I/O-RD
A3
I/O-BUS
U1
7445
U2
LS 32
LS 32
SCAN
LICOD
+5V
R8
R7
R6
R5
R4
1k
001 101 201 301 401 501 601 701
002 102 202 302 402 502 602 702
004 104 204 304 404 504 604 704
008 108 208 308 408 508 608 708
010 110 210 310 410 510 610 710
POT 1
POT 2
POT 3
R3
BRIGHT-NESS
100k
POWER ON LED
R2
120
+5V
CAUTION ! NEW NUMERING SYSTEM:
PIN-NUMBERS ARE EQUAL
TO FLAT RIBBON WIRE NUMBERS
WIRE 16
WIRE 1
J1
PIN 1
PHYSICAL ARRANGEMENT
MENU 410 | MONITOR 010 | MEM 001 | SCRATCH 101 | 7 201 | 6/DECR 301 | 9/INCR 401 | D 501 | E 601 | F 701
LIST 510 | OPT 110 | EXECUTE 002 | SEARCH 102 | 4/BIN 202 | 5/HEX 302 | 6/POS 402 | A 502 | B 602 | C 702
TMG 610 | SELECT 210 | LOC 004 | SET 104 | 1/OCT 204 | 2/ASCII 304 | 3/NEG 404 | 4 504 | 5 604 | HOME 704
STOP 710 | RUN 310 | ← 008 | → 108 | 0 208 | X 308 | CJ 408 | ← 508 | → 608 | ENTER 708
DOLCH
LOGIC INSTRUMENTS
KEYBOARD
PART NUMBER
5 4851-03 SCH
SHEET 1/1
DRAWN 18.3.81
CHECK
DATE
NAME
REVISIONS
CODE
ERN
DATE
B
A
30.4.81
18.3.81

POS	ITEM	DLI - PART - NO	QT
	7445		1
	LS 32		1
	LS 367 / 40097 / 80C97		1
R2	120 Ω		1
R3	Trimmer 100K		1
R4…8	1K		5
⏚	22 nF		2
DS1	LED (grün)		1
J1	16p. Flachbandkabel		1
	Tasten 6450 0001 (grau) Pfeile ↑↓→		4
	Tasten 6450 0001 (grau)		4
	Tasten 6450 0003 (dunkelgrau)		7
	Tasten 6450 0005 (anthrazit) 0-9		10
	Tasten 6450 0005 (anthrazit) A-F/X/[]		8
	Tasten 6450 0006 (rot) STP/ENT		2
	Taste 6450 0008 (grün) RUN		1
	Tasten 6450 0009 (blau)		4

CODE	ERN	REVISIONS	DATE	NAME	
				CHECK	
				DRAWN	2.6.81 fabritz

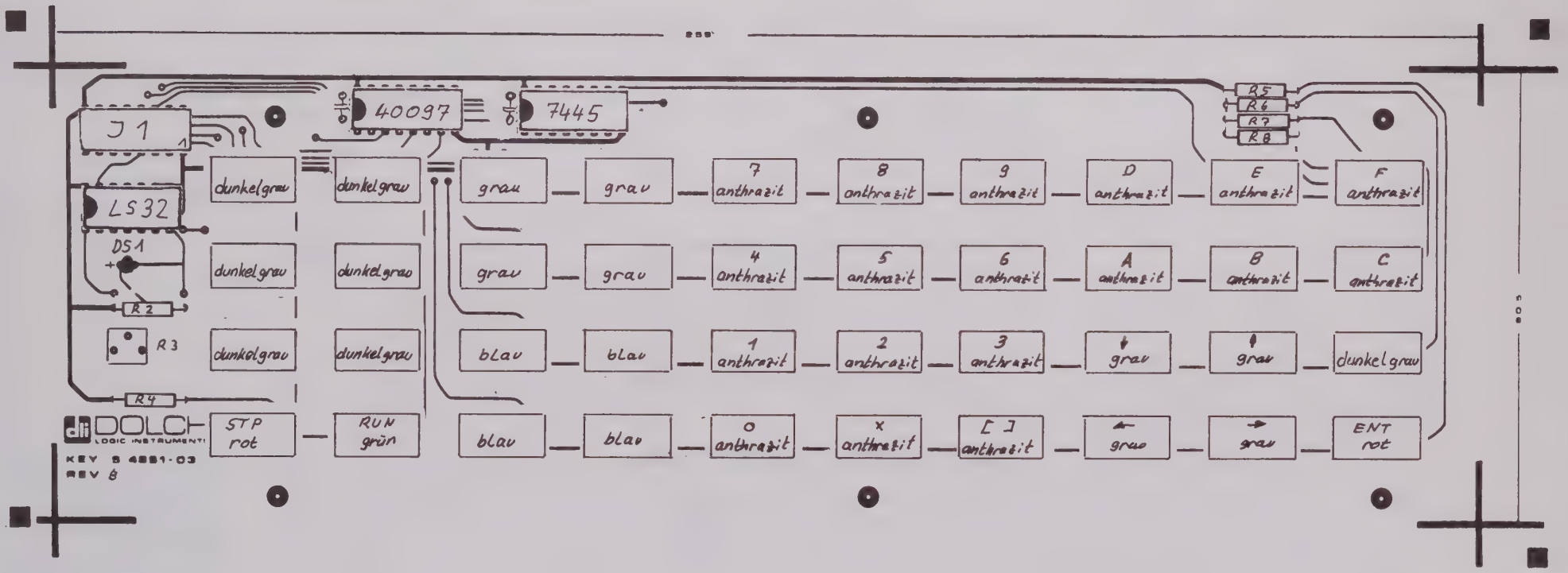
DOLCH LOGIC INSTRUMENTS

PART LIST

KEYBOARD Rev. B

PART NUMBER 54851-03

SHEET 1/1



CODE	ERN	DATE	REVISIONS	DATE	NAME		DOLCH LOGIC INSTRUMENTS
							ASS'Y DRAWING
							KEYBOARD Rev. B
				CHECK	DRAWN 2.6.81	Gehrke	PART NUMBER: 5 4851 - Ø3 A — SHEET: /

J3

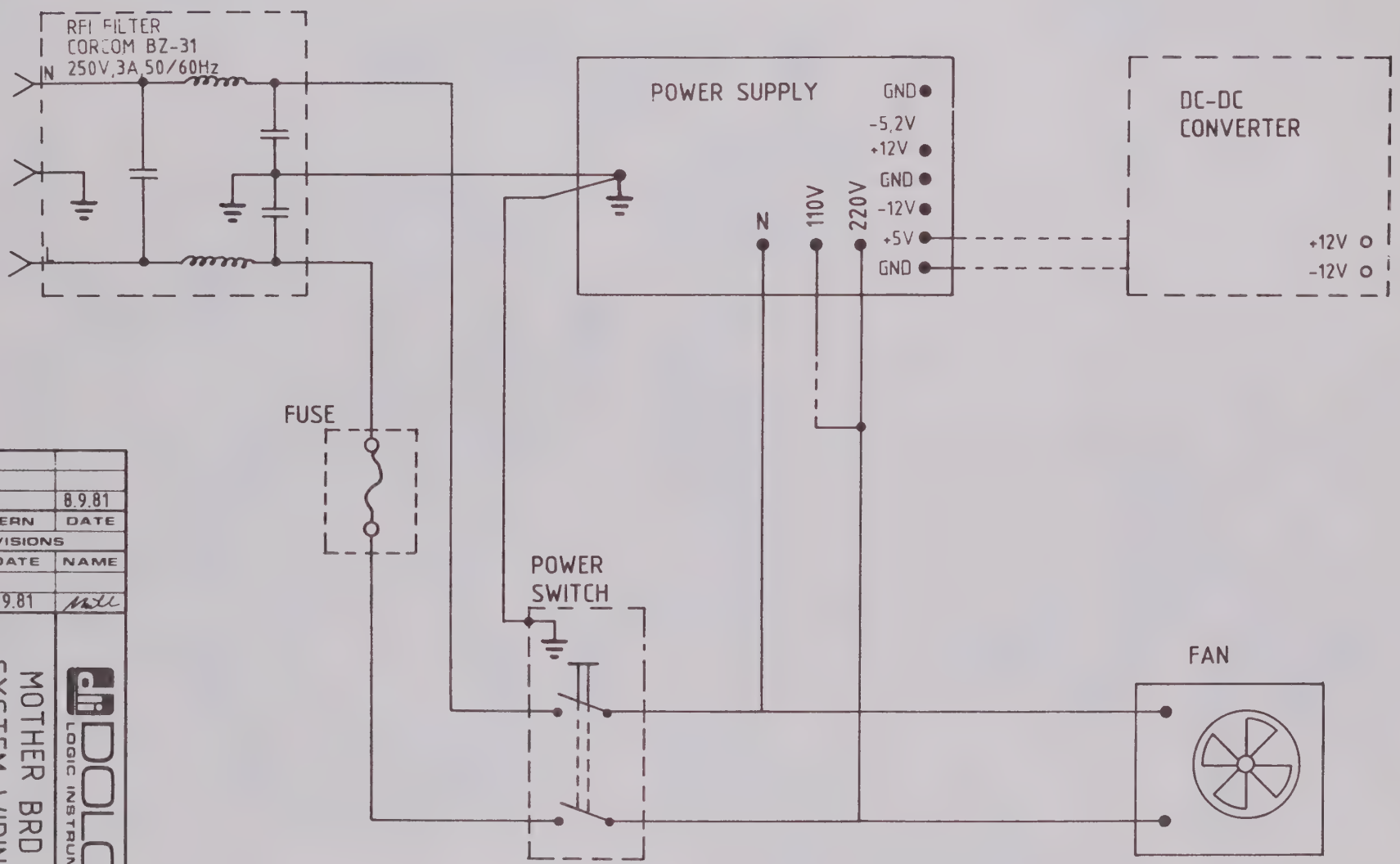
D 0	15	16	+5V
D 2	13	14	D 1
D 4	11	12	D 3
A 3	9	10	POT 1
$\overline{\text{I/O-RD}}$	7	8	POT 3
A 0	5	6	A 2
A 1	3	4	$\overline{\text{BRDS 0}}$
GND	1	2	POT 2

CODE	ERN	DATE	
	REVISIONS		
		DATE	NAME
		CHECK	
		DRAWN	21 12 81 Hull

DOLCH LOGIC INSTRUMENTS

KEYBOARD

PART NUMBER	SHEET
5. 4851 - 03	1 / 1



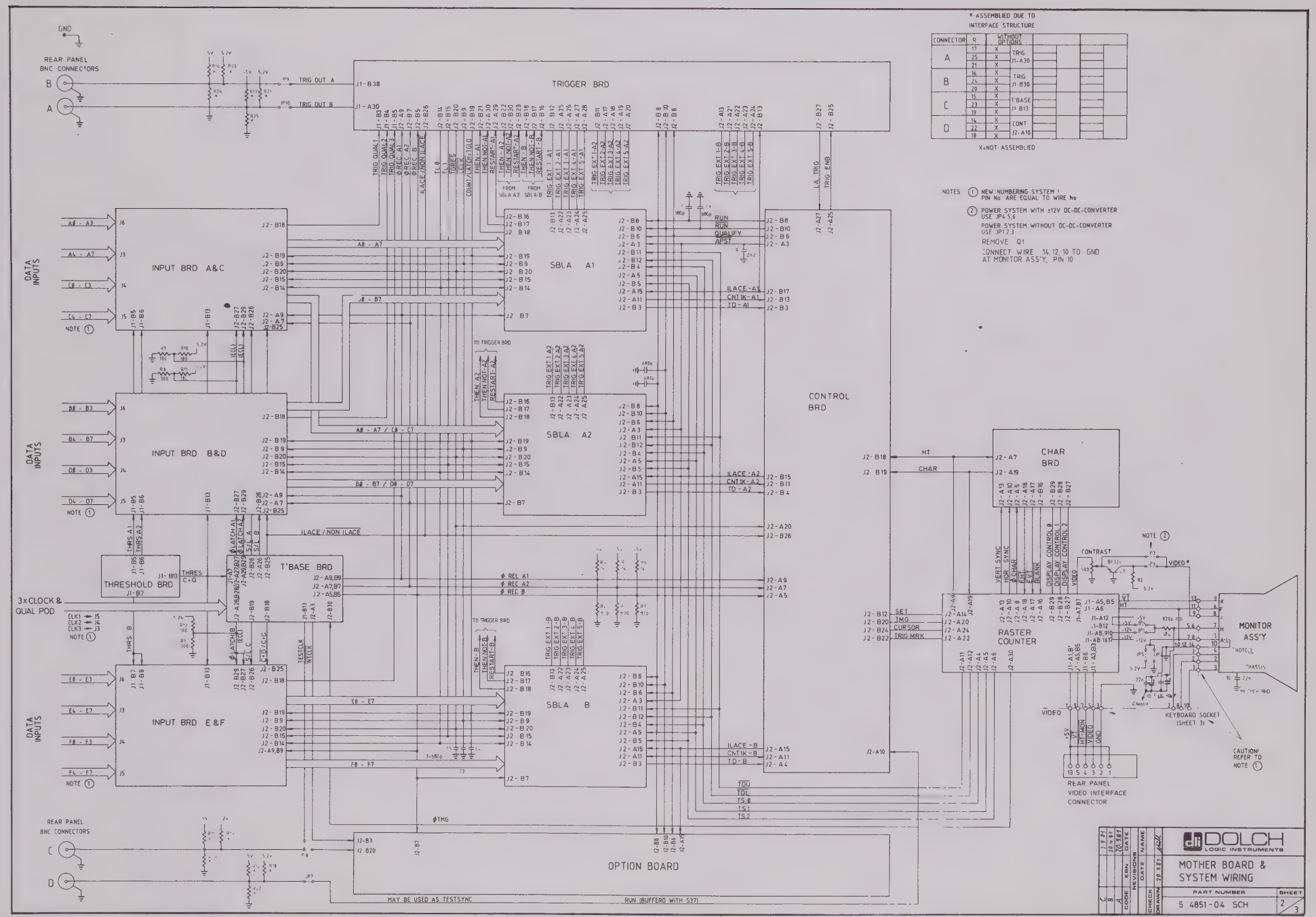
C		8.9.81
CODE	ERN	DATE
REVISIONS		
	DATE	NAME
CHECK		
DRAWN	8.9.81	

MOTHER BRD & SYSTEM WIRING

DOLCH LOGIC INSTRUMENTS

PART NUMBER 5 4851-04 SCH

SHEET 1/3



* ASSEMBLIED DUE TO INTERFACE STRUCTURE

CONNECTOR	R	WITHOUT OPTIONS	
A	17	X	TRIG J1-A30
	25	X	
	21	X	
B	16	X	TRIG J1 B30
	24	X	
	20	X	
C	15	X	T'BASE J1 B13
	23	X	
	19	X	
D	14	X	CONT J2-A10
	22	X	
	18	X	

X=NOT ASSEMBLIED

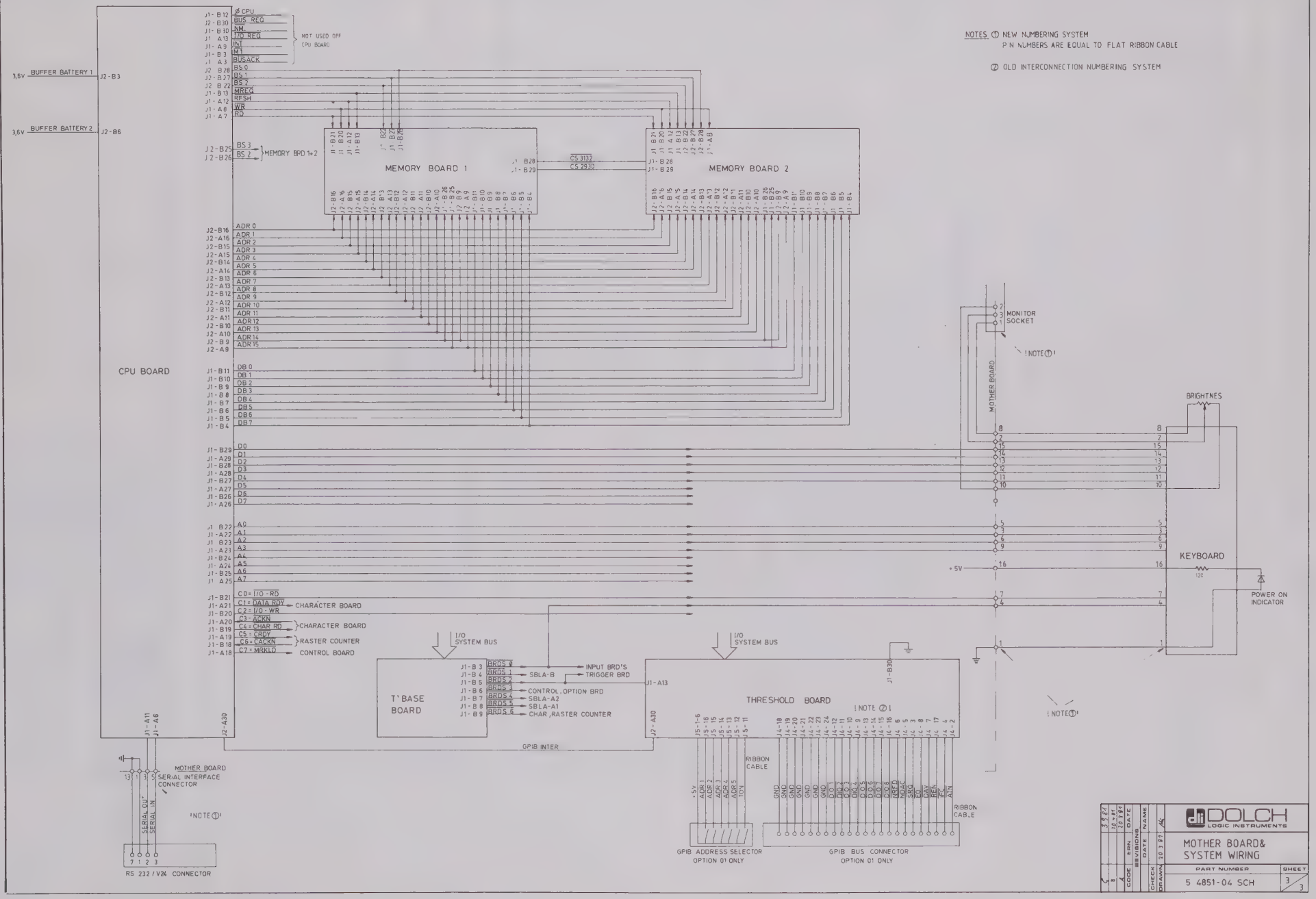
NOTES
1. NEW NUMBERING SYSTEM ! PIN No ARE EQUAL TO WIRE No
2. POWER SYSTEM WITH ±12V DC-DC-CONVERTER USE JP4 5,6
   POWER SYSTEM WITHOUT DC-DC-CONVERTER USE JP1 2 3
   REMOVE Q1
   CONNECT WIRE 14, 12, 10 TO GND AT MONITOR ASS'Y, PIN 10

CODE	REVISIONS	DATE	NAME
C		3 9 81	
B		30 9 81	
A		20 9 81	

DOLCH LOGIC INSTRUMENTS

MOTHER BOARD & SYSTEM WIRING

PART NUMBER	SHEET
5 4851-04 SCH	2/3


NOTES ① NEW NUMBERING SYSTEM
P.N NUMBERS ARE EQUAL TO FLAT RIBBON CABLE
② OLD INTERCONNECTION NUMBERING SYSTEM
CPU BOARD
3,6V BUFFER BATTERY 1
3,6V BUFFER BATTERY 2
NOT USED OFF CPU BOARD
MEMORY BOARD 1
MEMORY BOARD 2
MEMORY BRD 1+2
CS 3132
CS 2930
MONITOR SOCKET
MOTHER BOARD
BRIGHTNES
KEYBOARD
POWER ON INDICATOR
CHARACTER BOARD
RASTER COUNTER
CONTROL BOARD
I/O SYSTEM BUS
T'BASE BOARD
THRESHOLD BOARD
INPUT BRD'S
TRIGGER BRD
SBLA-B
CONTROL, OPTION BRD
SBLA-A2
SBLA-A1
CHAR, RASTER COUNTER
GPIB INTER
RIBBON CABLE
GPIB ADDRESS SELECTOR OPTION 01 ONLY
GPIB BUS CONNECTOR OPTION 01 ONLY
MOTHER BOARD SERIAL INTERFACE CONNECTOR
RS 232 / V24 CONNECTOR
SERIAL OUT
SERIAL IN
DOLCH LOGIC INSTRUMENTS
MOTHER BOARD& SYSTEM WIRING
PART NUMBER 5 4851-04 SCH
SHEET 3/3

POS	ITEM	DLI - PART - NO	QT
R7…9	300Ω		3
R1…3	120Ω		3
R4…6	1K		3
R10…12	180Ω		3
R14…25	nicht bestücken		
R27	NTC		1
R13	Trimmer 500Ω		1
C9	2n2		1
C1…5 7,8	680pF		7
C6	820pF		1
C10,14	22n		
	Battery		2
	Präzision Sockel 14p.		2
	Präzision Sockel 16p.		2
J1,J2	VG-Leisten 64p.		32
	Flachstecker (6,3×0,8)		6
C11,13	10µF/35V		2
C12	68n		1

CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	5.6.81	Gehrke

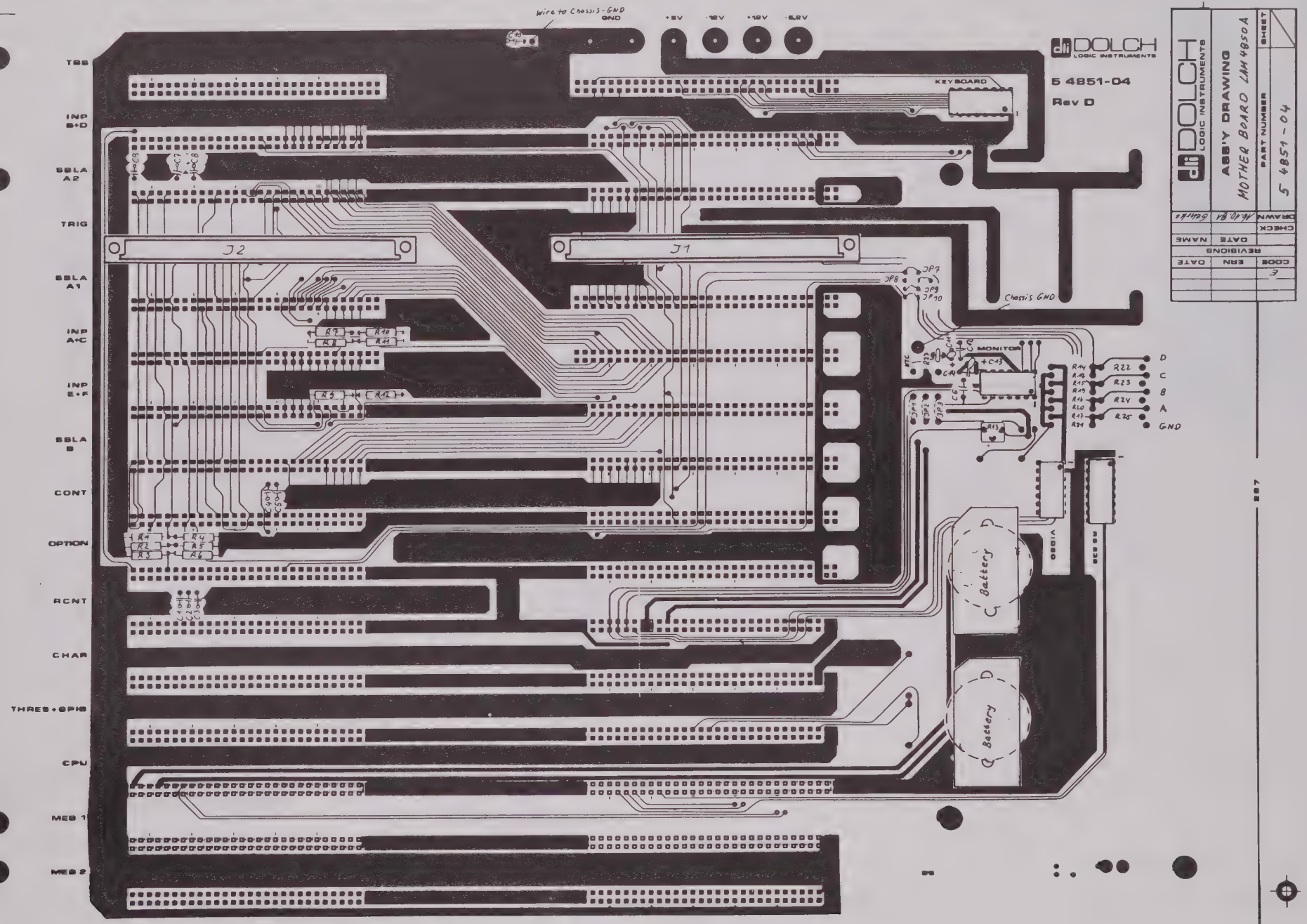
DOLCH LOGIC INSTRUMENTS

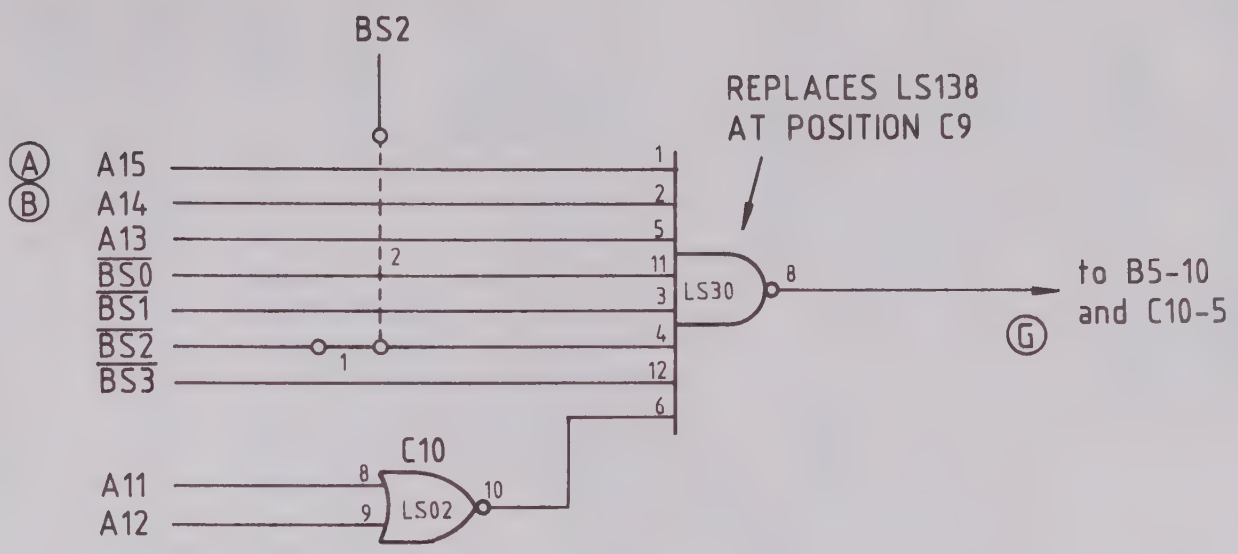
PART LIST

MOTHER BOARD Rev. E

PART NUMBER: 5 4851 - Ø4

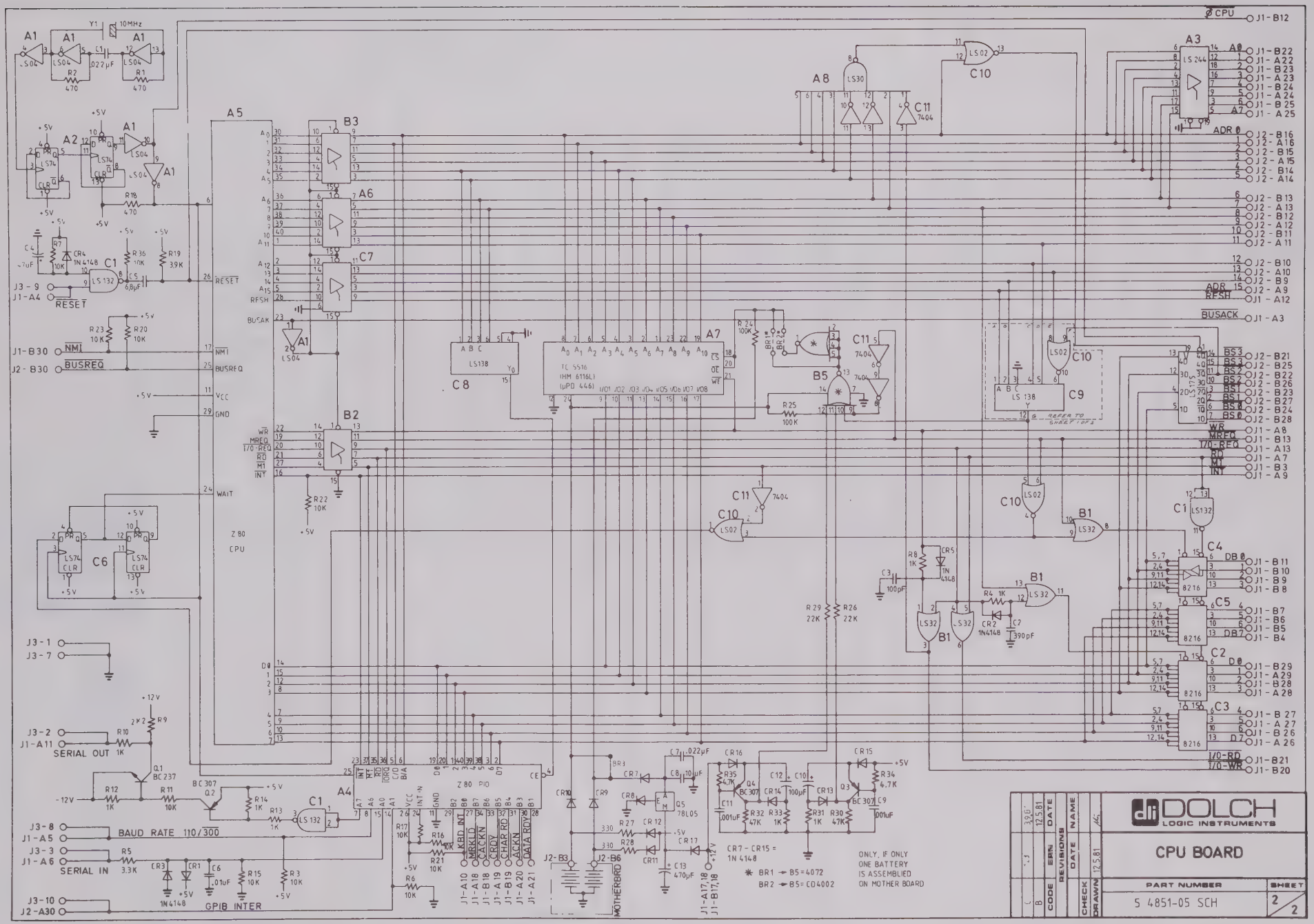
SHEET: 1/1


Wire to Chassis-GND
GND
+5V
-12V
+12V
-5.2V
TBS
INP B+D
SBLA A2
TRIG
SBLA A1
INP A+C
INP E+F
SBLA B
CONT
OPTION
RCNT
CHAR
THRES+GPIB
CPU
MEB 1
MEB 2
J2
J1
KEYBOARD
MONITOR
Chassis GND
Battery
Battery
D
C
B
A
GND
DOLCH LOGIC INSTRUMENTS
5 4851-04
Rev D
DOLCH LOGIC INSTRUMENTS
ASS'Y DRAWING
MOTHER BOARD LAM 4850A
PART NUMBER
5 4851-04
SHEET
DRAWN
CHECK
DATE
NAME
REVISIONS
CODE
ERN
DATE
287



NOTES: 1. REVISION C
REPLACE C9 (LS138) ON SHEET 2
2. USE JUMPER TO BS2 ONLY IF BANK 4 (CMOS RAM) IS NEEDED.

		8.9.81	DATE	REVISIONS	NAME		DOLCH LOGIC INSTRUMENTS
			ERN		DATE	8.9.81	CPU BOARD
		C	CODE		CHECK	DRAWN	PART NUMBER 5 4851-05 / SHEET 1/2



Z 80 CPU
Z 80 PIO
TC 5516 (HM 6116L) (µPD 4461)
SERIAL OUT
SERIAL IN
BAUD RATE 110/300
GPIB INTER
MOTHERBRD
CR7 - CR15 = 1N 4148
* BR1 → B5=4072
BR2 → B5=CD4002
ONLY, IF ONLY ONE BATTERY IS ASSEMBLIED ON MOTHER BOARD
DOLCH LOGIC INSTRUMENTS
CPU BOARD
PART NUMBER
5 4851-05 SCH
SHEET 2/2

POS	ITEM	DLI - PART - NO	QT
	7404		1
	LS 02		1
	LS 04		1
	LS 30		2
	LS 32		1
	LS 74		2
	LS 132		1
	LS 138		1
	LS 175		1
	LS 244		1
	LS 367		4
	HI 8216		4
	TC 5516 / HM 6116 LP		1
	CD 4002 / CD 4072		1
	Z 80 CPU		1
	Z 80 PIO		1
R24,25	100K		2
R1,2 18	470Ω		3
R 4,8 10,12			
R 13,14 31,33	1K		8
R27,28	330Ω		2
R9	2K2		1
R 5	3K3		1
R 19	3K9		1
R 34,35	4K7		2
R 3,6,7 11,15,16			
R 17,20,21 22,23,36	10K		12

CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	Gehrke 5.10.81

DOLCH LOGIC INSTRUMENTS

PART LIST

CPU Rev. C

PART NUMBER 5 4851 - Ø5

SHEET 1/2

POS	ITEM	DLI - PART - NO	QT
R26,29	22k		2
R30,32	47k		2
Q5	78L05		1
Q2,3,4	BC307		3
Q1	BC237		1
CR	1N4148		16
Y1	10 MHz		1
C3	100p		1
C2	390p		1
C9, 11	1n		2
C6	10n		1
C4	6,8 µF/25 V		1
C10,12	100µF/16V		2
C13	470µF/16V··· 40V		1
C1,7 ⏚	22n		13
C8 ⏚	10µF/35V		8
C5	47µF/6V		1
	Sockel 14p.		10
	Sockel 16p.		10
	Sockel 20p.		1
	Sockel 24p.		1
J3	Präzision-Sockel 16p.		1
	Präzision-Sockel 40p.		2
	Stiftleiste 2pol. (gerade)		1
	Stiftleiste 1pol. (gerade)		1
	Jumper 2pol.		1

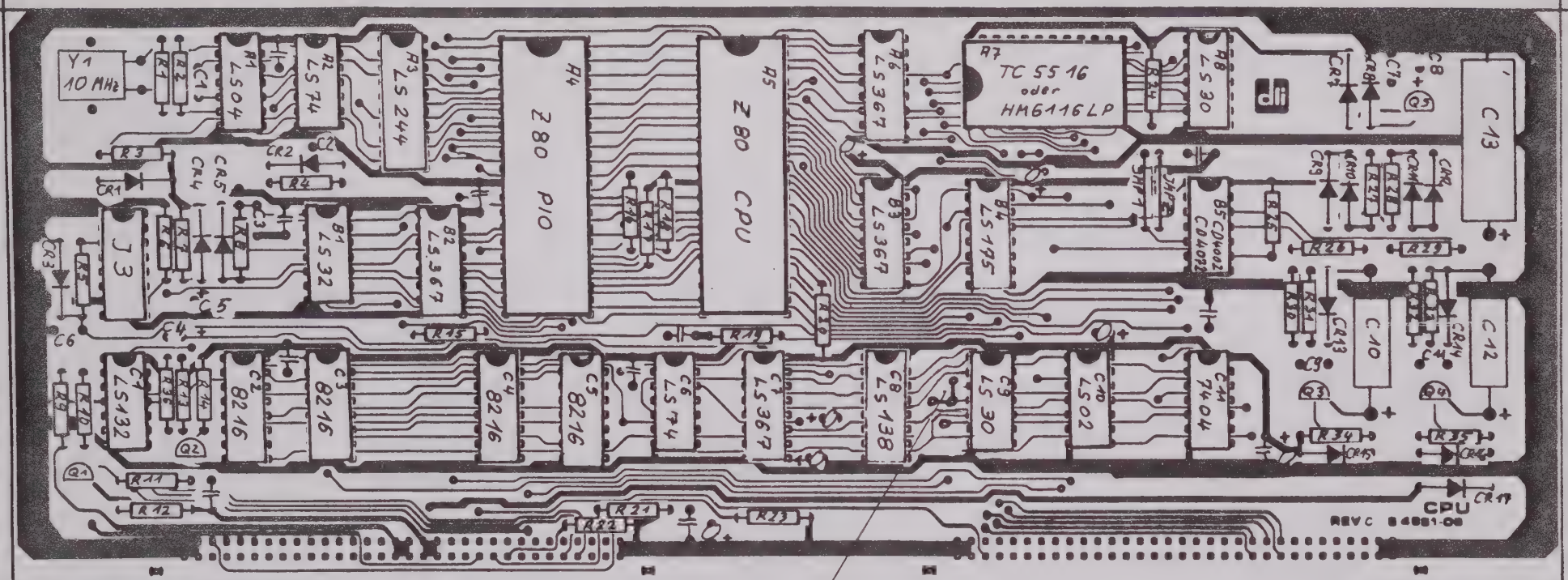
CODE | ERN | DATE | NAME
REVISIONS
DATE
CHECK
DRAWN 5.10.84 Gehrke

DOLCH
LOGIC INSTRUMENTS

PART LIST
CPU Rev. C

PART NUMBER 54851-05

SHEET 2/2



JMP 2 → CD 4002
JMP 1 → CD 4072

JMP : — LAM 4850 A

— alte Generationen

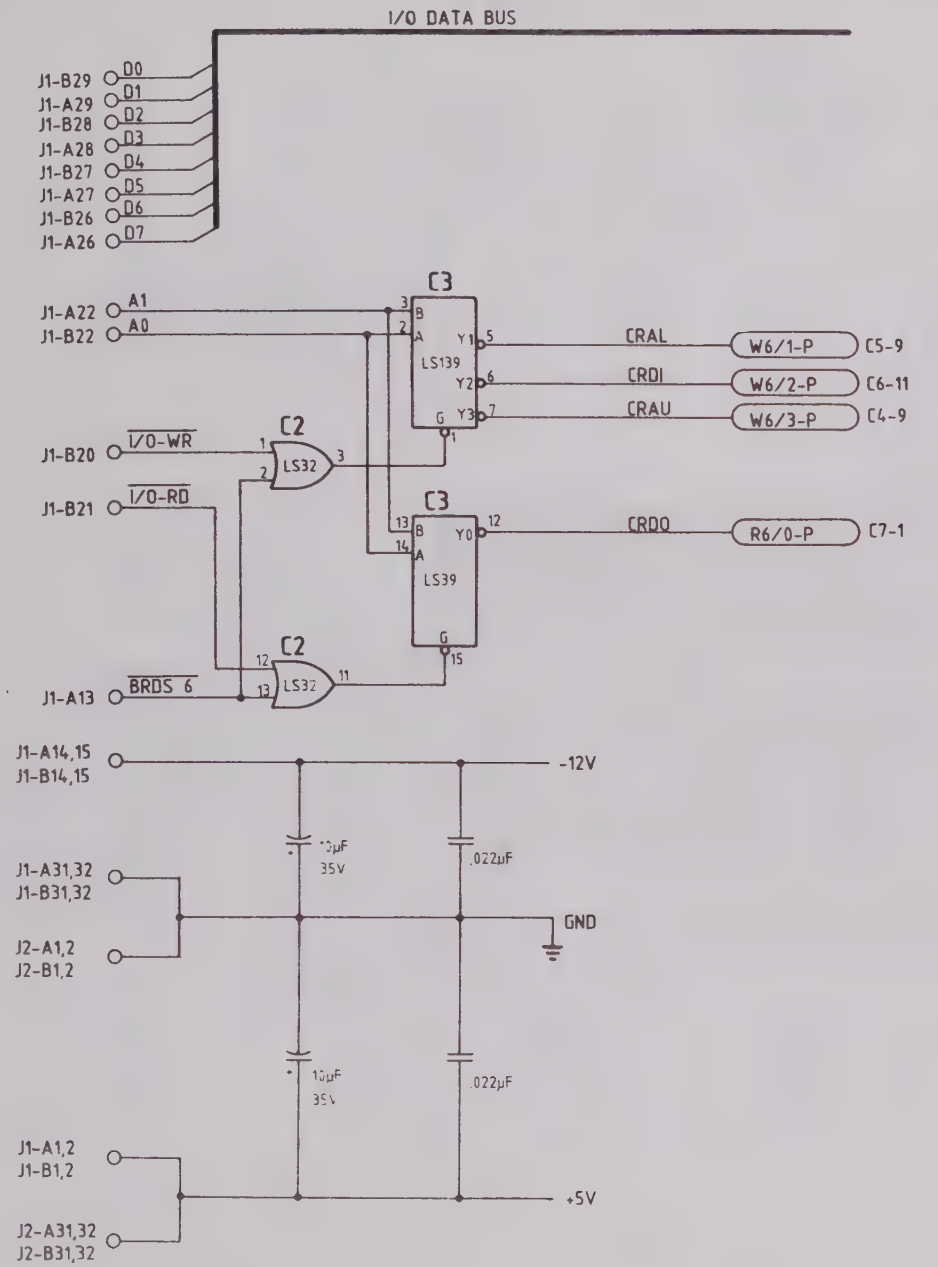
CODE	ERN	DATE	REVISIONS	DATE	NAME	DRAWN 5.10.81 Gehrke
						CHECK

DOLCH LOGIC INSTRUMENTS

ASS'Y DRAWING

CPU Rev. C

PART NUMBER	SHEET
5 4851 - Ø5 A	



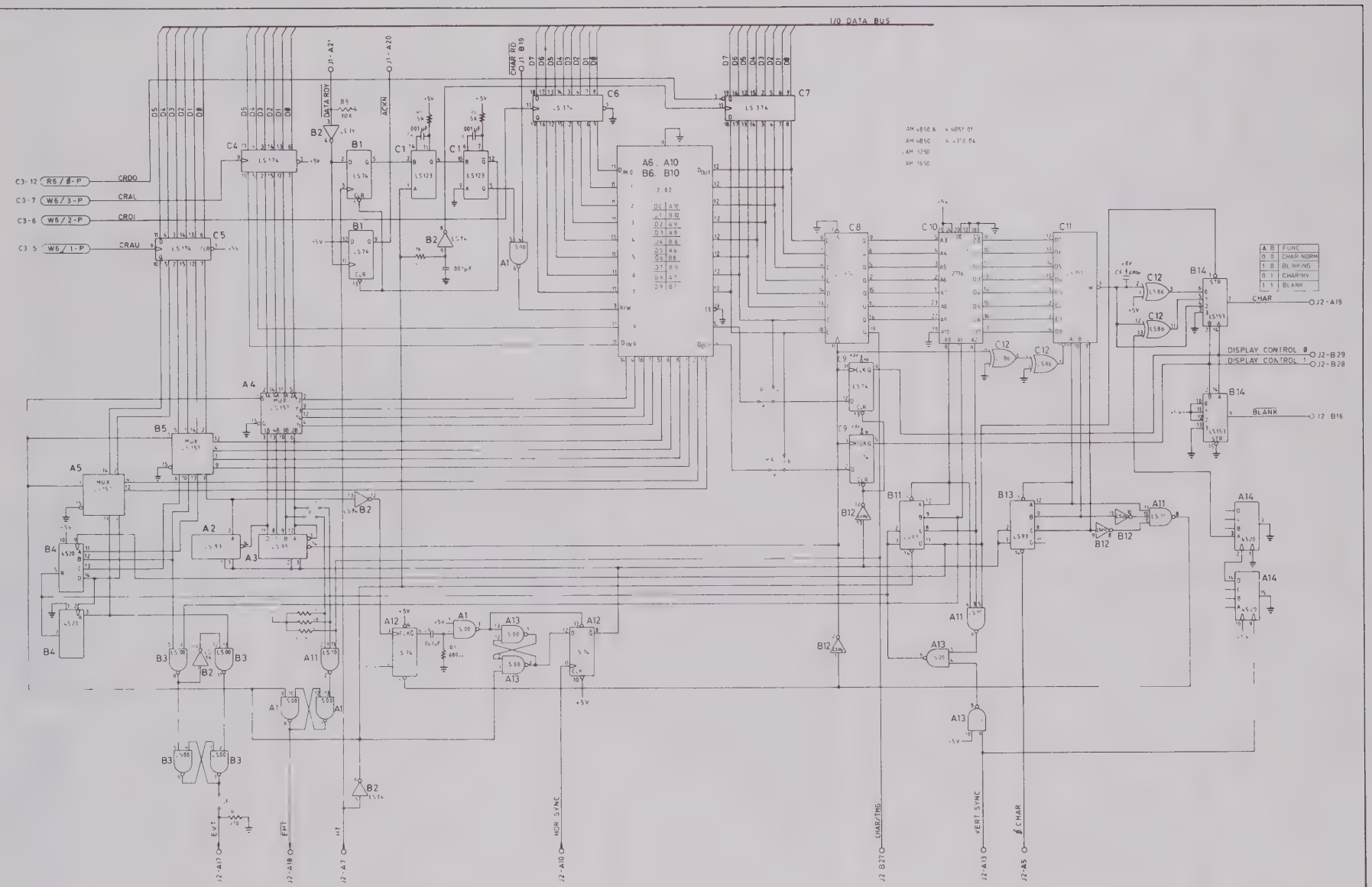
NOTES:
1. JUMPERS SHOWN FOR LAM 4850 A
2. DOTTED JUMPERS TO BE USED FOR LAM 1650, 3250,4850 REFER TO 5 4850-04

C	8.9.81	CODE	ERN	DATE	REVISIONS	NAME	
						DATE	
						CHECK	
						DRAWN	8.9.81

DOLCH LOGIC INSTRUMENTS

CHARACTER BOARD

PART NUMBER	SHEET
5 4851-07 SCH	1/2


I/O DATA BUS
CRDO
CRAL
CRDI
CRAU
DISPLAY CONTROL 0
DISPLAY CONTROL 1
CHAR
BLANK
HOR SYNC
CHAR/TMG
VERT SYNC
CHAR
DOLCH
LOGIC INSTRUMENTS
CHARACTER BOARD
PART NUMBER
5 4851-07 SCH
SHEET
2
2

POS	ITEM	DLI - PART - NO	QT
C5	680 p		1
C6**	68p		1
	Sockel 16p.		21
	Sockel 20p.		3
	Sockel 24p.		1
	Sockel 14p.		15
JP4,5	Stiftleiste (gerade) 3p.		2
	Stiftleiste (gerade) 2p.		2
	Jumper 2p.		4

** auf der Platine noch nicht vorgesehen

CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	S.M. 81	Gehrke

DOLCH LOGIC INSTRUMENTS

PART LIST

CHARACTER BOARD Rev. D

PART NUMBER: 5 4851 - Ø7

SHEET: 2/2

POS	ITEM	DLI - PART - NO	QT
	LS 00		1
	LS 04		1
	LS 10		1
	LS 32		1
	LS 74		2
	LS 86		1
	LS 93		4
	LS 123		1
	LS 139		1
	LS 151		1
	LS 153		1
	LS 157		3
	LS 174		2
	LS 374		3
	LS 14		1
	S 00		2
	S 74		1
	2102		10
	4520		2
*	2716 - 1		1
** R 9	10K		1
R 3	270Ω		1
R1	680Ω		1
R 2	1K		1
R 6,7,8	1K2		3
R 4,5	5K1		2
C 1...4	1nF		4
⏚	22nF		22
⏚	10µF/35V		1

* LAM 4850 - A2 : 4 4850-04

LAM 4851 - A : 4 4851-01

** auf der Platine noch nicht vorgesehen

CODE	ERN	DATE	NAME
CHECK			
DRAWN		5.11.81	Schmitz

REVISIONS

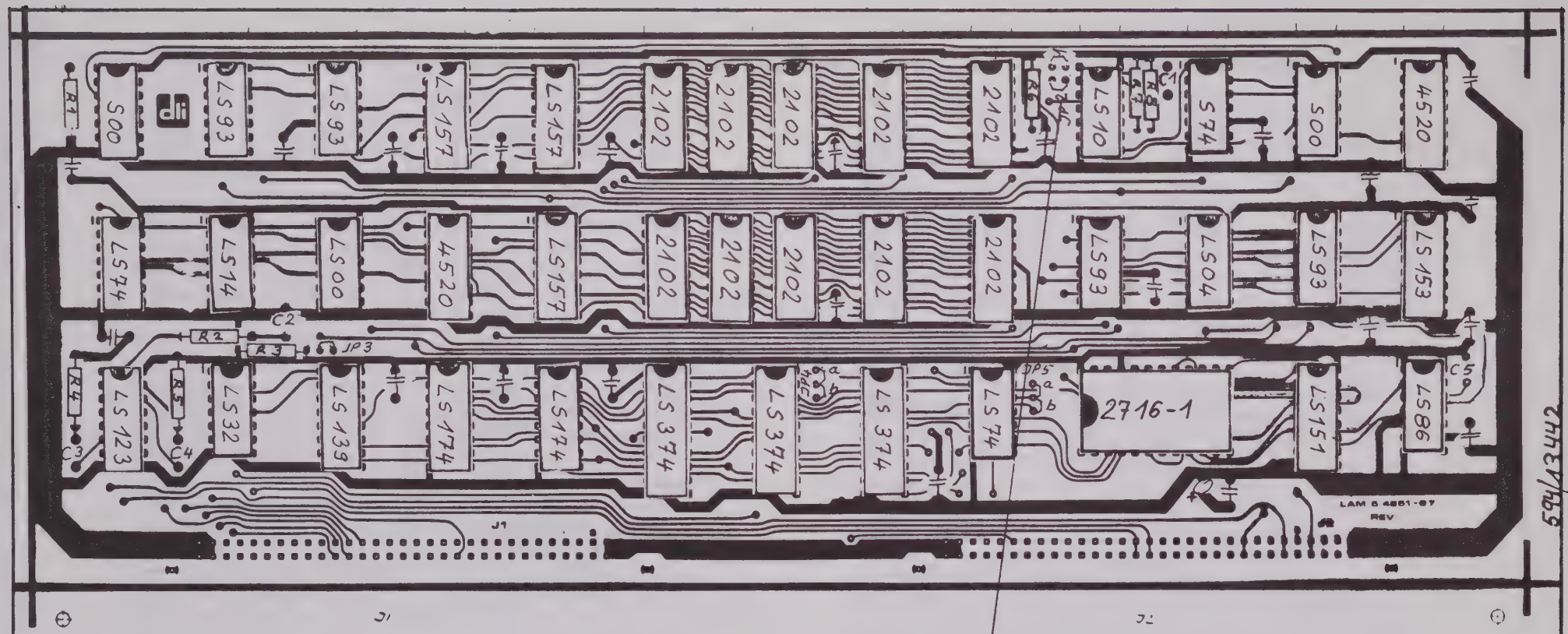
DOLCH LOGIC INSTRUMENTS

PART LIST

CHARACTER BOARD Rev. D

PART NUMBER 54851-07

SHEET 1/2



JP 5 a – 4850 A

b – 1650/3250/4850

JP4 a – 1650/3250/4850

b – 4850 A

JP3,2,1 – 1650/3250/4850

für LAM 1650/3250/4850 Leiterbahn auftrennen A 2

C6 = 68p between IC B14 – 9 ↔ +5V

CODE	ERN	DATE	REVISIONS	DATE	NAME		DOLCH LOGIC INSTRUMENTS
							ASS'Y DRAWING
							CHARACTER BOARD Rev D
				CHECK	DRAWN	5.11.81	Gehrke
							PART NUMBER: 5 4851-07 A
							SHEET

594/13442

J1

A		B
+5V	1	+5V
+5V	2	+5V
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
$\overline{\text{BRDS 6}}$	13	
-12V	14	-12V
-12V	15	-12V
+12V	16	+12V
+12V	17	+12V
C7=$\overline{\text{MRKLD}}$	18	C6=$\overline{\text{CACKN}}$
C5=$\overline{\text{CRDY}}$	19	C4=$\overline{\text{CHAR RD}}$
C3=$\overline{\text{ACKN}}$	20	C2=$\overline{\text{I/O-WR}}$
C1=$\overline{\text{DATA RDY}}$	21	C0=$\overline{\text{I/O-RD}}$
A 1	22	A 0
A 3	23	A 2
A 5	24	A 4
A 7	25	A 6
D 7	26	D 6
D 5	27	D 4
D 3	28	D 2
D 1	29	D 0
	30	
GND	31	GND
GND	32	GND

J2

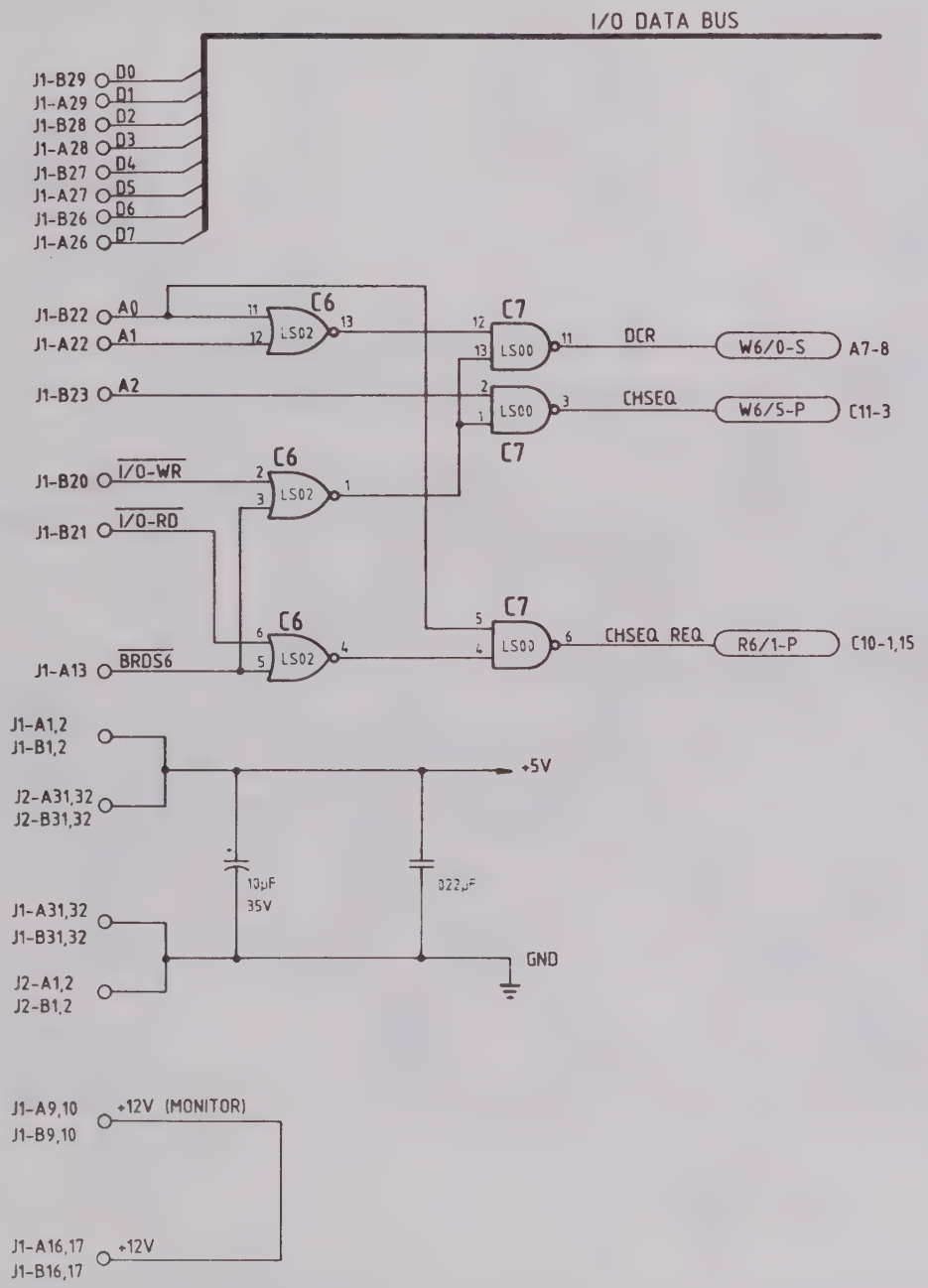
A		B
GND	1	GND
GND	2	GND
	3	
	4	
Ø CHAR	5	
	6	
HT	7	
	8	
	9	
HOR SYNC	10	
	11	
	12	
VERT SYNC	13	
	14	
	15	
	16	$\overline{\text{BLANK}}$
$\overline{\text{EVT}}$	17	
$\overline{\text{EHT}}$	18	
CHAR	19	
	20	
	21	
	22	
	23	
	24	
	25	
	26	
	27	
	28	
	29	
	30	
+5V	31	+5V
+5V	32	+5V

CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	21.12.81	Mill

DOLCH LOGIC INSTRUMENTS

CHARACTER BOARD

PART NUMBER	SHEET
5 4851 - 07	1/1



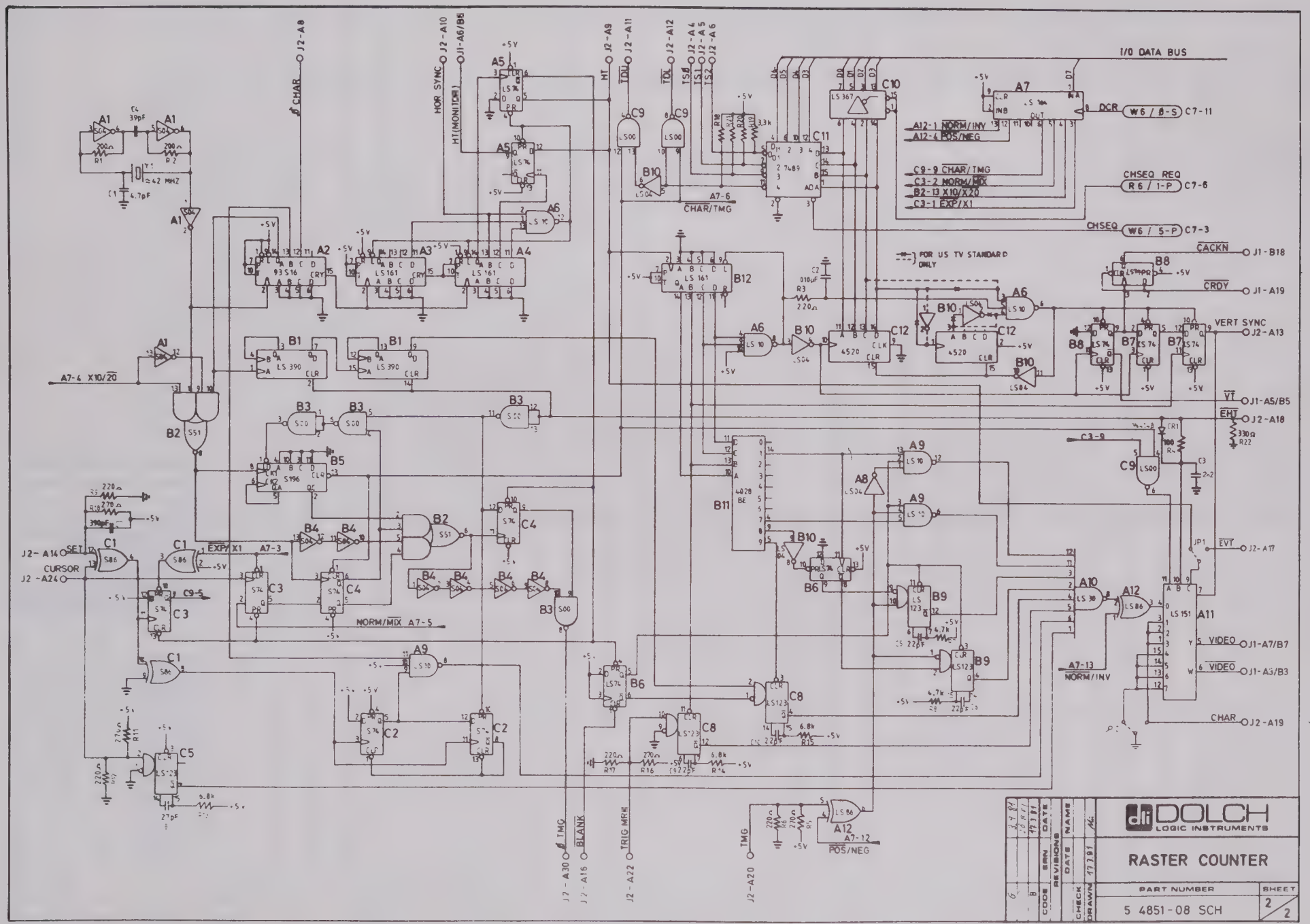
NOTES: 1. JUMPERS J1,J2 SHOWN FOR LAM 4850 A
2. FOR OPERATION WITHIN LAM 1650, 3250, 4850:
REFERENCE: 5 4850-03

REVISIONS			
	ERN	DATE	NAME
CODE	G	8.9.81	
CHECK		DATE	
DRAWN		8.9.81	

DOLCH LOGIC INSTRUMENTS

RASTER COUNTER

PART NUMBER	SHEET
5 4851-08 SCH	1/2


I/O DATA BUS
DCR W6 / 8-S C7-11
CHSEQ REQ R6 / 1-P C7-6
CHSEQ W6 / 5-P C7-3
CACKN J1-B18
CRDY J1-A19
VERT SYNC J2-A13
VT J1-A5/B5
EHT J2-A18
EVT J2-A17
VIDEO J1-A7/B7
VIDEO J1-A3/B3
CHAR J2-A19
A12-1 NORM/INV
A12-4 POS/NEG
C9-9 CHAR/TMG
C3-2 NORM/MIX
B2-13 X10/X20
C3-1 EXP/X1
FOR US TV STANDARD ONLY
A7-6 CHAR/TMG
A7-4 X10/20
A7-3 EXP/X1
A7-5 NORM/MIX
A7-13 NORM/INV
A7-12 POS/NEG
J2-A14 SET
CURSOR J2-A24
J2-A30 TMG
J2-A16 BLANK
J2-A22 TRIG MRK
J2-A20 TMG
HOR SYNC J2-A10
HT(MONITOR) J1-A6/B6
CHAR J2-A8
HT J2-A9
TDU J2-A11
TDL J2-A12
TS0 J2-A4
TS1 J2-A5
TS2 J2-A6
DOLCH LOGIC INSTRUMENTS
RASTER COUNTER
PART NUMBER
5 4851-08 SCH
SHEET 2/2
REVISIONS
CODE
ERN
DATE
NAME
CHECK
DRAWN

POS	ITEM	DLI - PART - NO	QT
	LS 00		2
	LS 02		1
	LS 04		2
	LS 10 (nur Texas IC's verwenden)		2
	LS 30		1
	LS 74		4
	LS 86		1
	LS 123		3
	LS 151		1
	LS 161 / LS 163		3
	LS 164		1
	LS 367		1
	LS 390 (nur Texas IC's verwenden)		1
	S 00		1
	S 04		2
	S 51		1
	S 74		3
	S 86		1
	S 196		1
	93 S 16 / S 163		1
	7489		1
	4520		1
	4028		1
* CR1	1N 4148		1
Y1	Quartz 42,2 MHz		1

* auf der Platine noch nicht vorgesehen

CODE	ERN	DATE	NAME
		DATE	
CHECK			
DRAWN	13.11.81		Gehrke

REVISIONS

DOLCH LOGIC INSTRUMENTS

PART LIST

COUNTER BOARD Rev. H

PART NUMBER 5 4851 - 08

SHEET 1/2

POS	ITEM	DLI - PART - NO	QT
R1,2	200Ω		2
R3,6,9, 11,17	220 Ω		5
R5,10 12,16	270 Ω		4
R4	100Ω		1
* R22	330 Ω		1
R18,19 20,21	3k3		4
R7,8	4k7		2
R13,14,15	6k8		3
C1	4p7		1
C5,6 9,10	22p		4
C8	27p		1
C4	39p		1
C7	390p		1
C3	2,2n		1
C2	10n		1
⏚	22n		12
⌀	10µF/35V		5
	Sockel 14p.		23
	Sockel 16p.		13
	Stiftleiste (gerade) 2p.		2
	Jumper 2p.		2

* auf der Platine noch nicht vorgesehen

CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	13.12.81	Gehrke

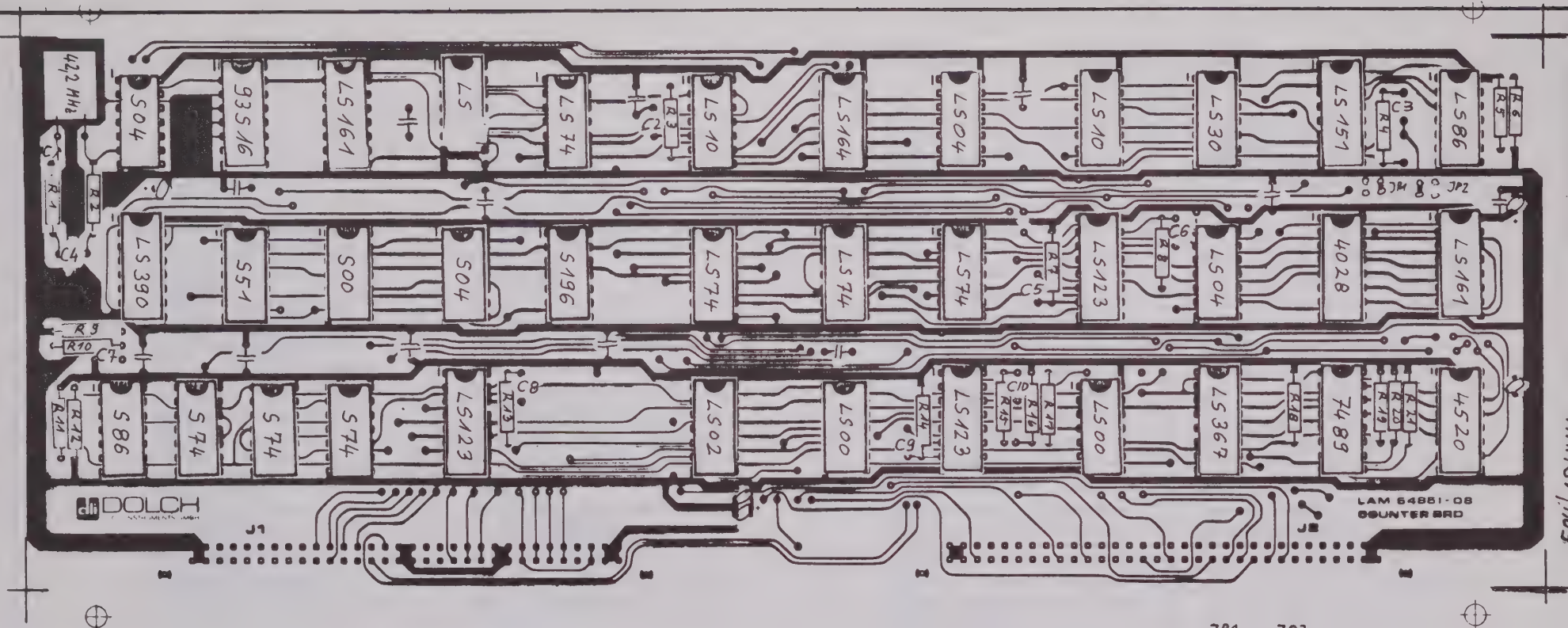
DOLCH LOGIC INSTRUMENTS

PART LIST

COUNTER BOARD Rev. H

PART NUMBER: 5 4851 - 08

SHEET: 2/2

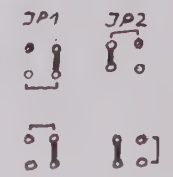


Jumper W-Germany

USA

LAM 4850 A

LAM 1650/3250/4850



CODE	ERN	DATE	NAME		
	REVISIONS	DATE			
CHECK					
DRAWN	13.11.81	Gehrke			

DOLCH LOGIC INSTRUMENTS

ASS'Y DRAWING

COUNTER BOARD Rev H

PART NUMBER: 5 4851-08 A

SHEET

J1

A		B
+5V	1	+5V
+5V	2	+5V
$\overline{\text{VIDEO}}$	3	$\overline{\text{VIDEO}}$
	4	
$\overline{\text{VT}}$	5	$\overline{\text{VT}}$
HT (MONITOR)	6	$\overline{\text{HT (MONITOR)}}$
VIDEO	7	VIDEO
$\overline{\text{VIDEO}}$	8	$\overline{\text{VIDEO}}$
+12V (MONITOR)	9	+12 V (MONITOR)
+12V (MONITOR)	10	+12 V (MONITOR)
VT	11	VT
	12	
$\overline{\text{BRDS 6}}$	13	N/C
-12V	14	-12V
-12V	15	-12V
+12V	16	+12V
+12V	17	+12V
C7=$\overline{\text{MRKLD}}$	18	C6=$\overline{\text{CACKN}}$
C5=$\overline{\text{CRDY}}$	19	C4=$\overline{\text{CHAR RD}}$
C3=$\overline{\text{ACKN}}$	20	C2=$\overline{\text{I/O-WR}}$
C1=$\overline{\text{DATA RDY}}$	21	C0=$\overline{\text{I/O-RD}}$
A 1	22	A 0
A 3	23	A 2
A 5	24	A 4
A 7	25	A 6
D 7	26	D 6
D 5	27	D 4
D 3	28	D 2
D 1	29	D 0
	30	
GND	31	GND
GND	32	GND

J2

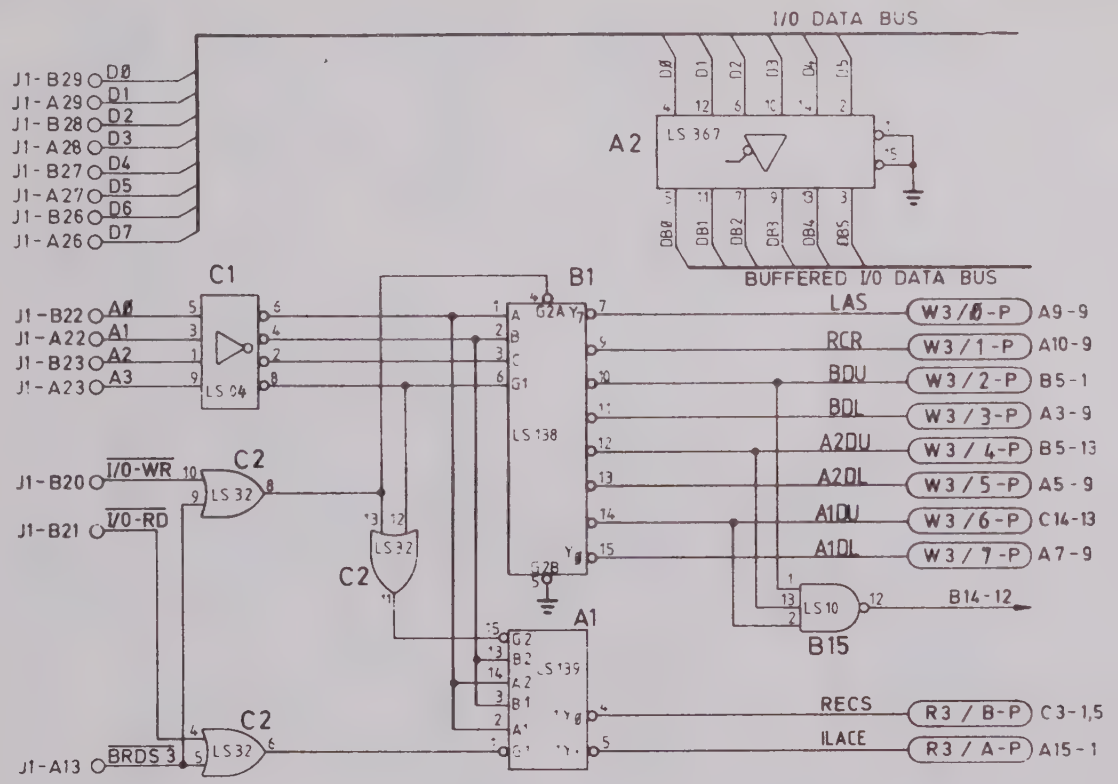
A		B
GND	1	GND
GND	2	GND
	3	
TS 0	4	
TS 1	5	
TS 2	6	
	7	
Ø CHAR	8	
HT	9	
HOR SYNC	10	
$\overline{\text{TDU}}$	11	
$\overline{\text{TDL}}$	12	
VERT SYNC	13	
SET	14	
	15	
$\overline{\text{BLANK}}$	16	
$\overline{\text{EVT}}$	17	
$\overline{\text{EHT}}$	18	
CHAR	19	
TMG	20	
	21	
TRIG MRK	22	
	23	
CURSOR	24	
	25	
	26	
	27	
	28	
	29	
Ø TMG	30	
+5V	31	+5V
+5V	32	+5V

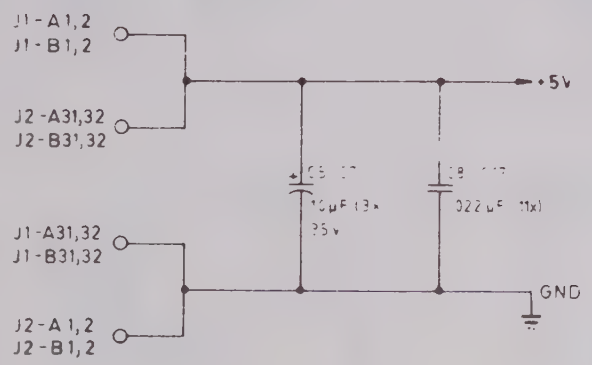
CODE	ERN	DATE	REVISIONS	DATE	NAME	CHECK	DRAWN	21.12.81	Mill

DOLCH LOGIC INSTRUMENTS

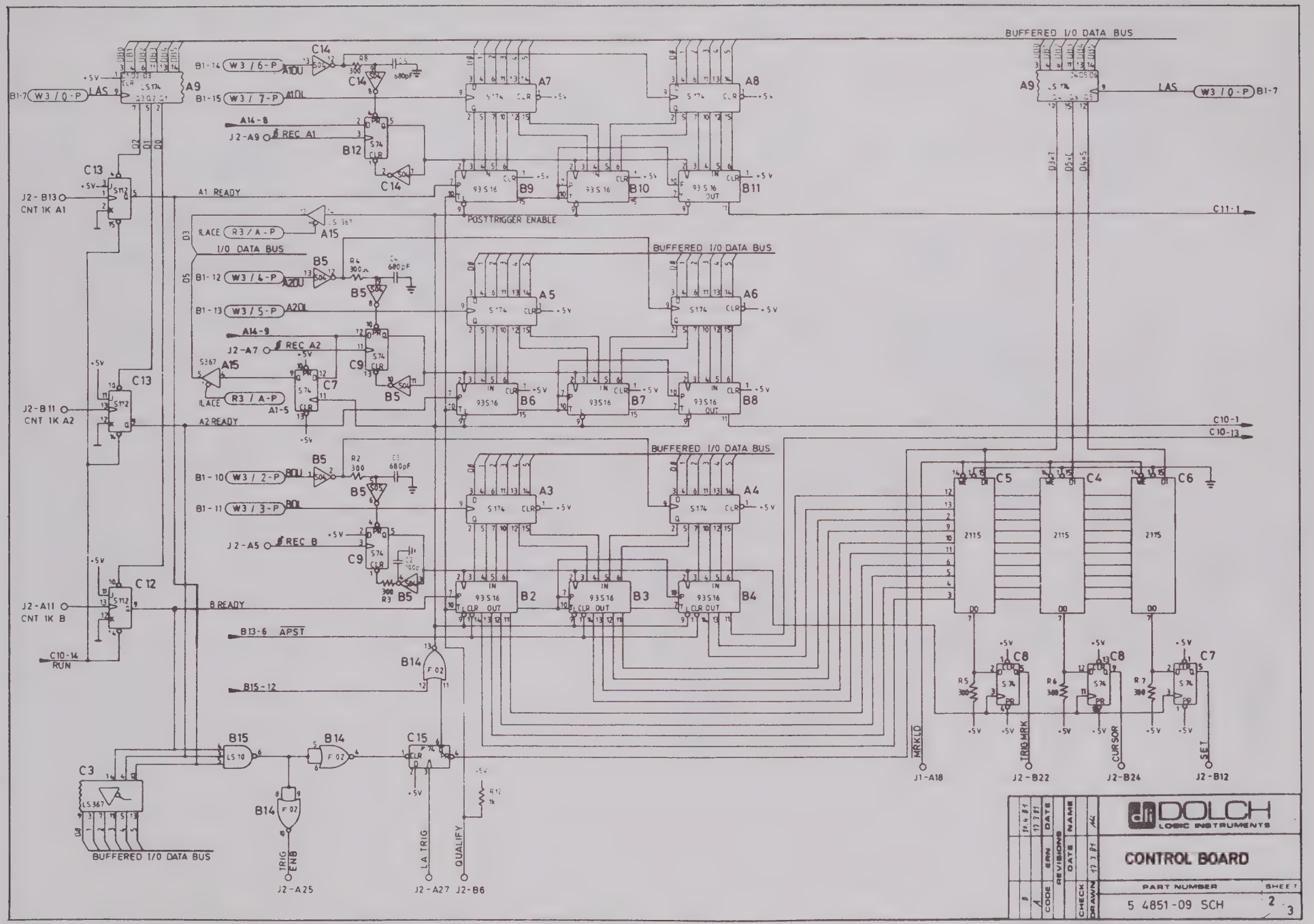
RASTER COUNTER BOARD

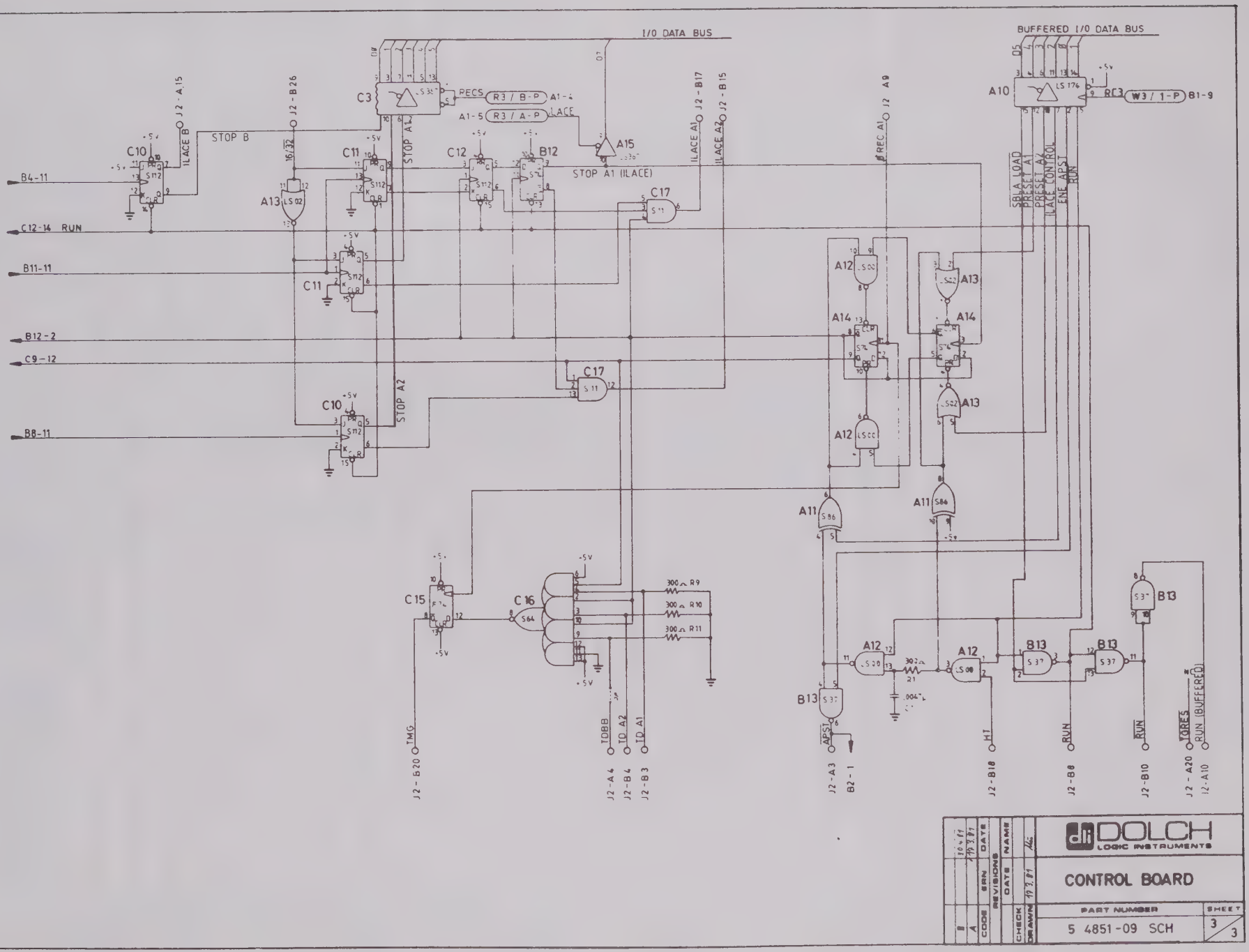
PART NUMBER	SHEET
5 4851 - 08	1/1





B	30.4.81					DOLCH LOGIC INSTRUMENTS
A	28.4.81	ERN	DATE	NAME		CONTROL BOARD
CODE		REVISIONS		CHECK		PART NUMBER: 5 4851-09 SCH
				DRAWN	28.4.81	SHEET: 1/3


BUFFERED I/O DATA BUS
A1 READY
A2 READY
B READY
POSTTRIGGER ENABLE
B13-6 APST
B15-12
MRKLD
J1-A18
J2-B22
J2-B24
J2-B12
J2-A25
J2-A27
J2-B6
CONTROL BOARD
DOLCH
LOGIC INSTRUMENTS
5 4851-09 SCH
SHEET 2 3


I/O DATA BUS
BUFFERED I/O DATA BUS
STOP B
STOP A1
STOP A2
STOP A1 (ILACE)
ILACE B
ILACE A1
ILACE A2
REC A1
B4-11
C12-14 RUN
B11-11
B12-2
C9-12
B8-11
SBLA LOAD
PRESET A1
PRESET A2
ILACE CONTROL
ENE APST
RUN
TMG
TDBB
TD A2
TD A1
APST
HT
RUN
RUN
TORES
RUN (BUFFERED)
J2-B20
J2-A4
J2-B4
J2-B3
J2-A3
B2-1
J2-B18
J2-B8
J2-B10
J2-A20
J2-A10
DOLCH
LOGIC INSTRUMENTS
CONTROL BOARD
PART NUMBER
5 4851-09 SCH
SHEET
3/3
CODE
SRN
DATE
REVISIONS
CHECK
DRAWN

POS	ITEM	DLI - PART - NO	QT
	LS00		1
	LS02		1
	LS04		1
	LS 10		1
	LS 32		1
	LS 112		1
	LS 138		1
	LS 139		1
	LS 174		2
	LS 367		3
	F 02		1
	S 04		2
	S 11		1
	S 37		1
	S 64		1
	•S 74		3
	S 86		1
	S 112		3
	S 174		6
	93S 16		9
	2115		3
	F 74		3
R1...11	300 Ω		11
R 12	680Ω		1
C1	4n7		1
C2	100p		1
C3...5	680p		3
⏚	22n		11
Q	10µF/35V		3
	Sockel 14p.	18	
	Sockel 16p.	29	

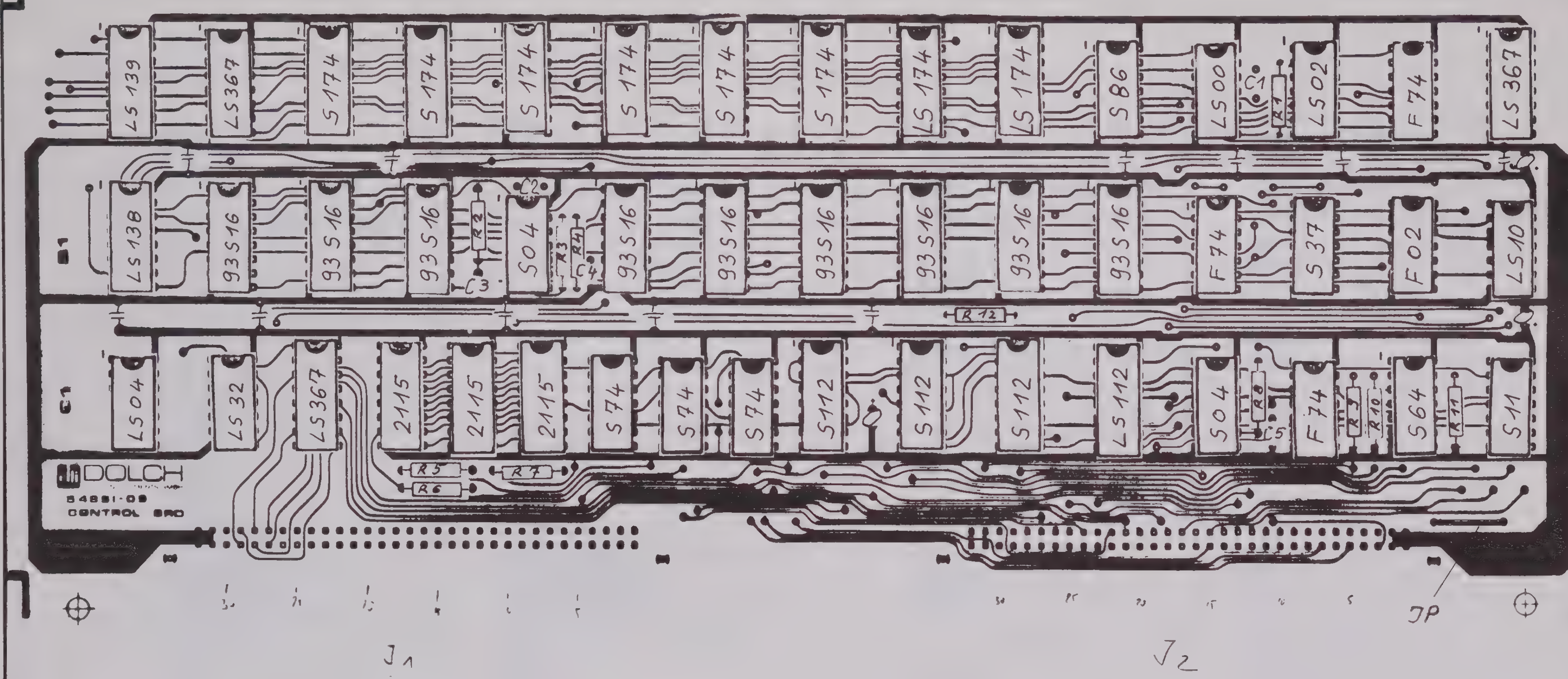
CODE	ERN	DATE	NAME
	REVISIONS		
		DATE	
	CHECK		
	DRAWN	12.10.81	Gehrke

DOLCH LOGIC INSTRUMENTS

PART LIST

CONTROL BOARD Rev. D

PART NUMBER	SHEET
5 4851-09	1/1



CODE	ERN	DATE

REVISIONS

	DATE	NAME
CHECK		
DRAWN	12.10.81	Gehrke

DOLCH LOGIC INSTRUMENTS

ASS'Y DRAWING

CONTROL BOARD Rev. D

PART NUMBER	SHEET
5 4851 - 09 A	

J1

A		B
+5V	1	+5V
+5V	2	+5V
	3	
	4	
CLK ON/$\overline{\text{OFF}}$	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
$\overline{\text{BRDS 3}}$	13	
-12V	14	-12V
-12V	15	-12V
+12V	16	+12V
+12V	17	+12V
C7=$\overline{\text{MRKLD}}$	18	C6=$\overline{\text{CACKN}}$
C5=$\overline{\text{CRDY}}$	19	C4=$\overline{\text{CHAR RD}}$
C3=$\overline{\text{ACKN}}$	20	C2=$\overline{\text{I/O-WR}}$
C1=$\overline{\text{DATA RDY}}$	21	C0=$\overline{\text{I/O-RD}}$
A 1	22	A 0
A 3	23	A 2
A 5	24	A 4
A 7	25	A 6
D 7	26	D 6
D 5	27	D 4
D 3	28	D 2
D 1	29	D 0
	30	
GND	31	GND
GND	32	GND

J2

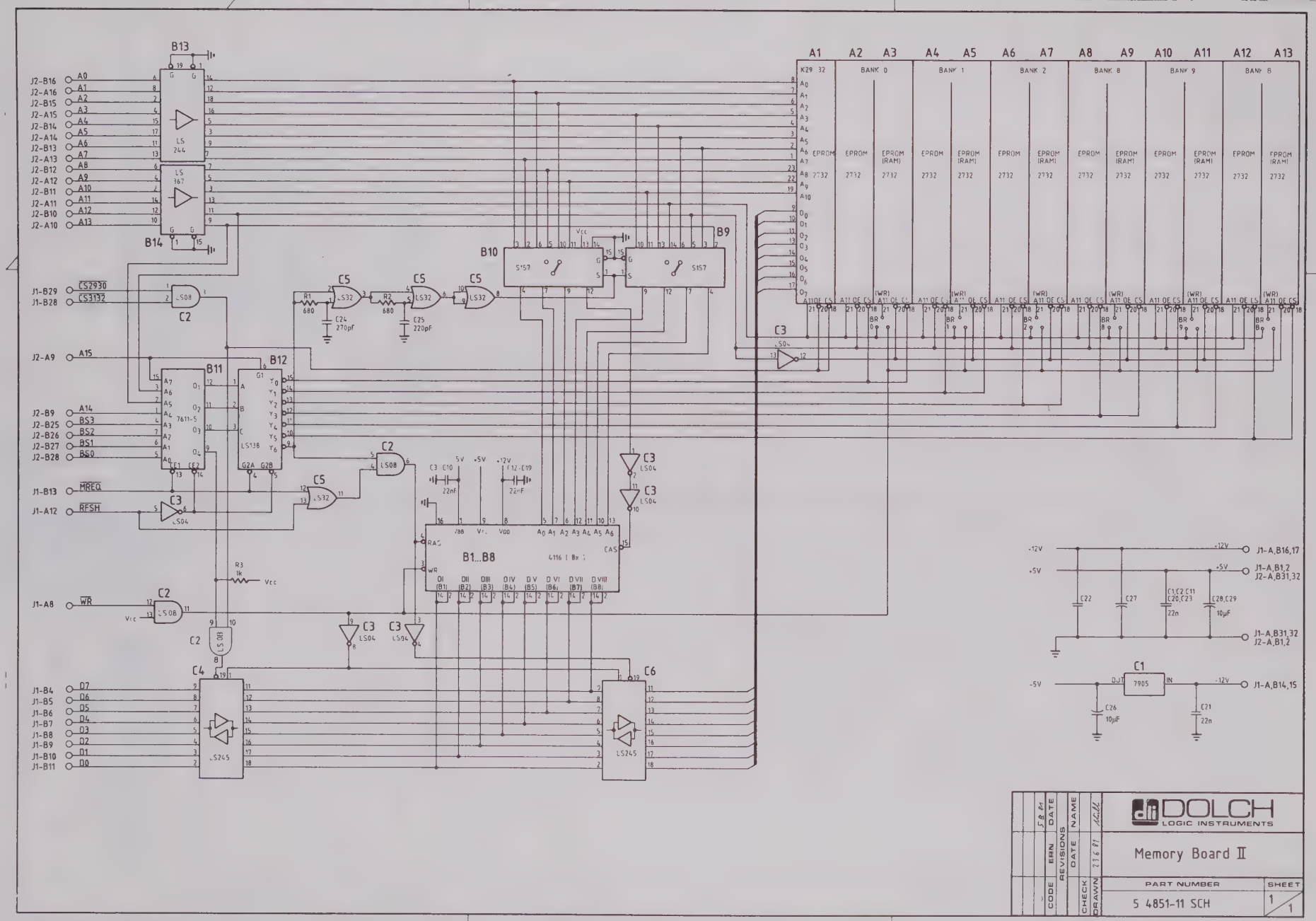
A		B
GND	1	GND
GND	2	GND
$\overline{\text{APST}}$	3	TD A 1
TDB	4	TD A 2
Ø REC B	5	
	6	$\overline{\text{RRES}}$
Ø REC A 2	7	
	8	RUN
Ø REC A 1	9	
BUFFERED RUN	10	$\overline{\text{RUN}}$
CNT 1 K B	11	CNT 1 K A 2
	12	SET
	13	CNT 1 K A 1
	14	
ILACE B	15	ILACE A 2
	16	
	17	ILACE A 1
	18	HT
	19	CHAR
$\overline{\text{TGRES}}$	20	TMG
	21	
	22	TRIG MRK
	23	
	24	CURSOR
TRIG ENB	25	
	26	16/$\overline{32}$
LATRIG	27	
	28	
	29	
	30	
+5V	31	+5V
+5V	32	+5V

CODE	ERN	DATE	REVISIONS	NAME	DATE
				CHECK	
				DRAWN	24.12.84 Mich

DOLCH LOGIC INSTRUMENTS

CONTROL BOARD

PART NUMBER	SHEET
5 4851 - 09	1/1



B13
B14
B11
B12
B10
B9
C2
C3
C4
C5
C6
C1
LS 244
LS 367
LS08
LS32
LS04
LS245
7611-5
LS138
S157
B1...B8
4116 (8x)
K29 32
BANK 0
BANK 1
BANK 2
BANK 8
BANK 9
BANK 8
EPROM
EPROM (RAM)
2732
J2-B16
J2-B15
J2-A15
J2-B14
J2-A14
J2-B13
J2-A13
J2-B12
J2-A12
J2-B11
J2-A11
J2-B10
J2-A10
J1-B29
J1-B28
CS2930
CS3132
J2-A9
A15
J2-B9
J2-B25
J2-B26
J2-B27
J2-B28
A14
BS3
BS2
BS1
BS0
J1-B13
MREQ
J1-A12
RFSH
J1-A8
WR
J1-B4
J1-B5
J1-B6
J1-B7
J1-B8
J1-B9
J1-B10
J1-B11
D7
D6
D5
D4
D3
D2
D1
D0
R1 680
R2 680
R3 1k
C24 270pF
C25 220pF
C3 C10 22nF
C12-C19 22nF
+12V
+5V
-5V
J1-A,B16,17
J1-A,B1,2
J2-A,B31,32
J1-A,B31,32
J2-A,B1,2
J1-A,B14,15
C22
C27
C1,C2,C11 C20,C23 22n
C28,C29 10µF
C26 10µF
C21 22n
7905
DOLCH
LOGIC INSTRUMENTS
Memory Board II
PART NUMBER
5 4851-11 SCH
SHEET
1
1
CODE
ERN
DATE
REVISIONS
DATE
NAME
CHECK
DRAWN

POS	ITEM	DLI - PART - NO	QT
	LS 04		1
	LS 08		2
	LS 32		1
	LS 138		1
	S 157		2
	LS 244		1
	LS 245		2
	LS 367		1
	4864		8
	7611 (44851-02)		1
	2732		14
*R4	SIL 8x 4k7		1
R1,2	680Ω		2
R3	1K		1
C1	270p		1
C2	220p		1
⊣⊢	22n		13
⊜	10µF/35V		2
JMP1-6	Stiftleiste (gerade) 3p.		6
	Jumper 2p.		6
	Sockel 14p.		4
	Sockel 16p.		13
	Sockel 20p.		3
	Sockel 24p.		14

* auf der Platine noch nicht vorgesehen

CODE	ERN	DATE	NAME
	REVISIONS	DATE	
		CHECK	
		DRAWN 27.10.81	Gehrke

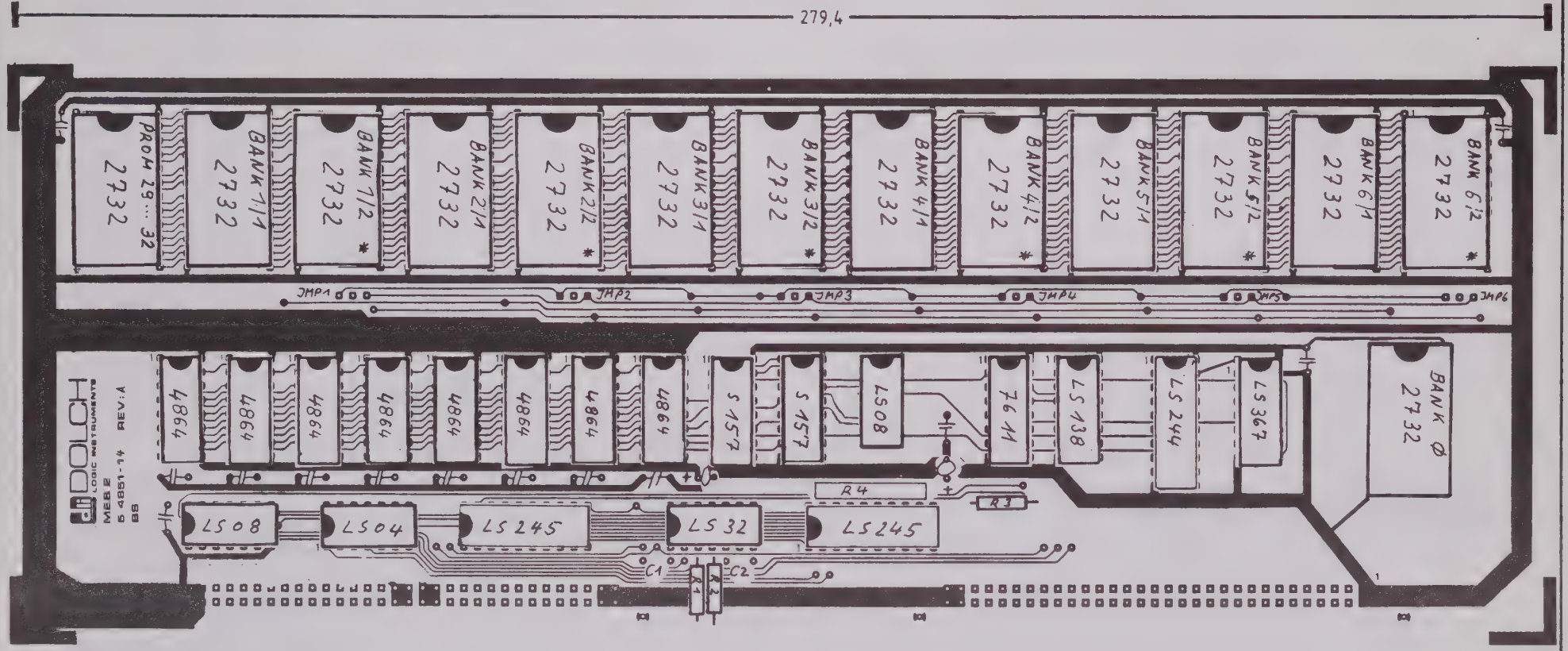
DOLCH LOGIC INSTRUMENTS

PART LIST

MEB 2 Rev. B

PART NUMBER 5 4851 - 14

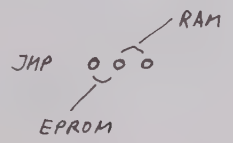
SHEET 1/1



Best.s.

R4 von unten bestücken

Alle Widerstände haben RM 10,16mm!



* Option: RAM 6116

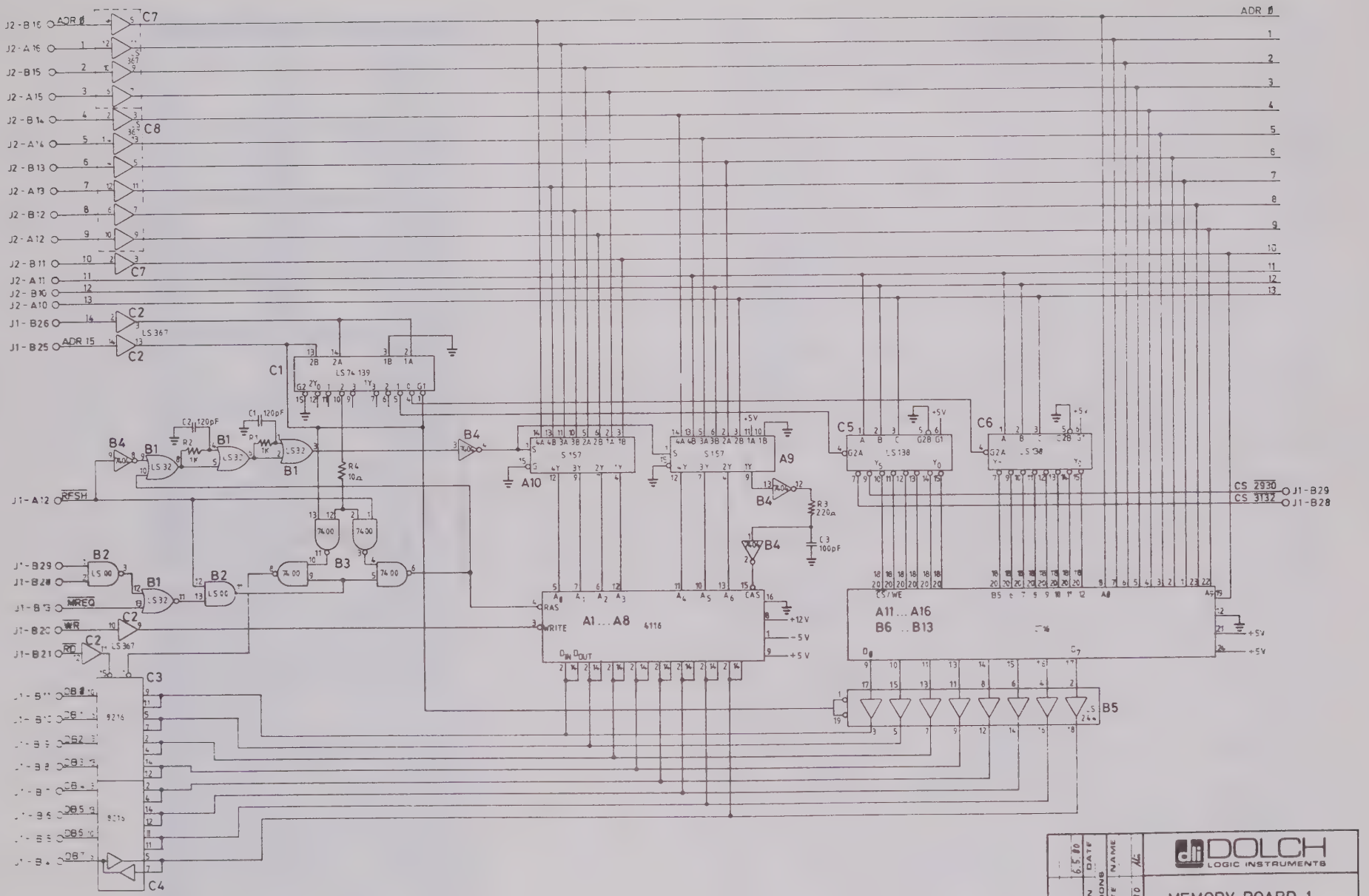
CODE	ERN	DATE	REVISIONS	DATE	NAME	
				CHECK	DRAWN 27.10.81	Gehrke

DOLCH LOGIC INSTRUMENTS

ASS'Y DRAWING

MEB 2 Rev.: B

PART NUMBER	SHEET
5 4851-14	



DOLCH LOGIC INSTRUMENTS

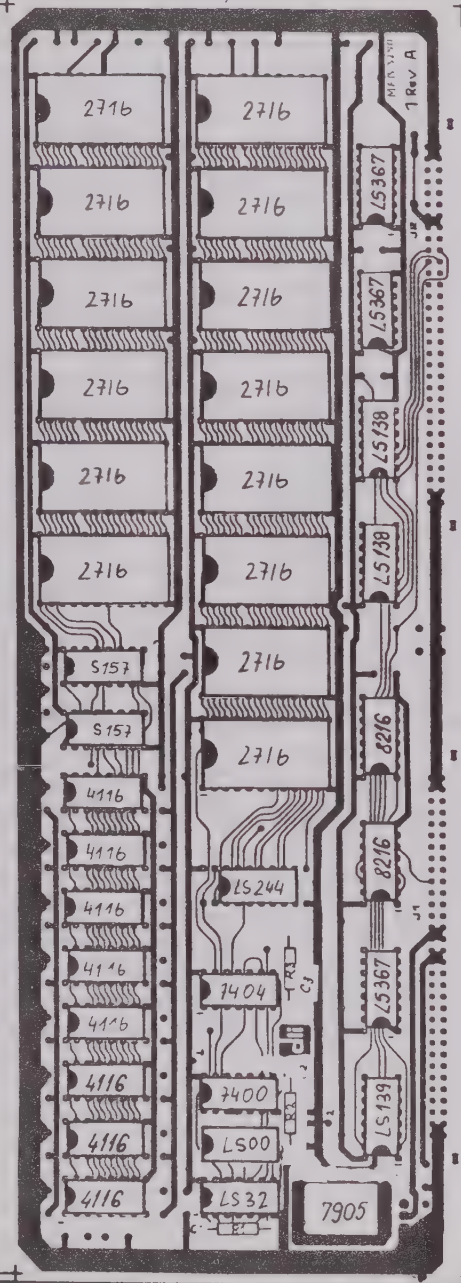
MEMORY BOARD 1

PART NUMBER	SHEET
5 3250-06	2/2

CODE	ERN	DATE	NAME
A		6.5.80	

REVISIONS

CHECK	DATE	NAME
DRAWN	6.5.80	



POS.	ITEM	QTY
	7400	1
	7404	1
	LS 32	1
	LS 00	1
	LS 139	1
	S 157	2
	LS 244	1
	LS 367	3
	LS 138	2
	8216	2
	4116	8
	2716	14
	7905 Voltage Regulator	1
$R_{1,2}$	1K	2
R_3	220 Ω	1
$C_{1,2}$	120 p	2
C_3	100 p	1
	10 µF / 35 V	8
	22 n	38

POS	ITEM	QTY
	16P Sockel	18
	14P Sockel	4
	20P Sockel	1
	24P Sockel	14

Maßstab LAM 3250

ASS'Y DRAWING - PART LIST

Zust.	Änderung	Datum	Name
		Datum	Name
Bearb		30.7.80	Gehrke
Gepr		11.8.80	C Claus
Norm			

DOLCH LOGIC INSTRUMENTS GMBH

5 3250 - 06

MEB 1 3250 A

Blatt 81

J1

A		B
+5V	1	+5V
+5V	2	+5V
	3	
	4	DB 7
	5	DB 6
	6	DB 5
	7	DB 4
	8	DB 3
	9	DB 2
	10	DB 1
	11	DB Ø
$\overline{\text{RFSH}}$	12	$\overline{\text{Ø}}$
	13	$\overline{\text{MREQ}}$
-12V	14	-12V
-12V	15	-12V
+12V	16	+12V
+12V	17	+12V
	18	
	19	
	20	$\overline{\text{WR}}$
	21	
	22	$\overline{\text{RD}}$
	23	
	24	
	25	ADR 15
	26	ADR 14
	27	
	28	$\overline{\text{CS 3132}}$
	29	$\overline{\text{CS 2930}}$
	30	
GND	31	GND
GND	32	GND

J2

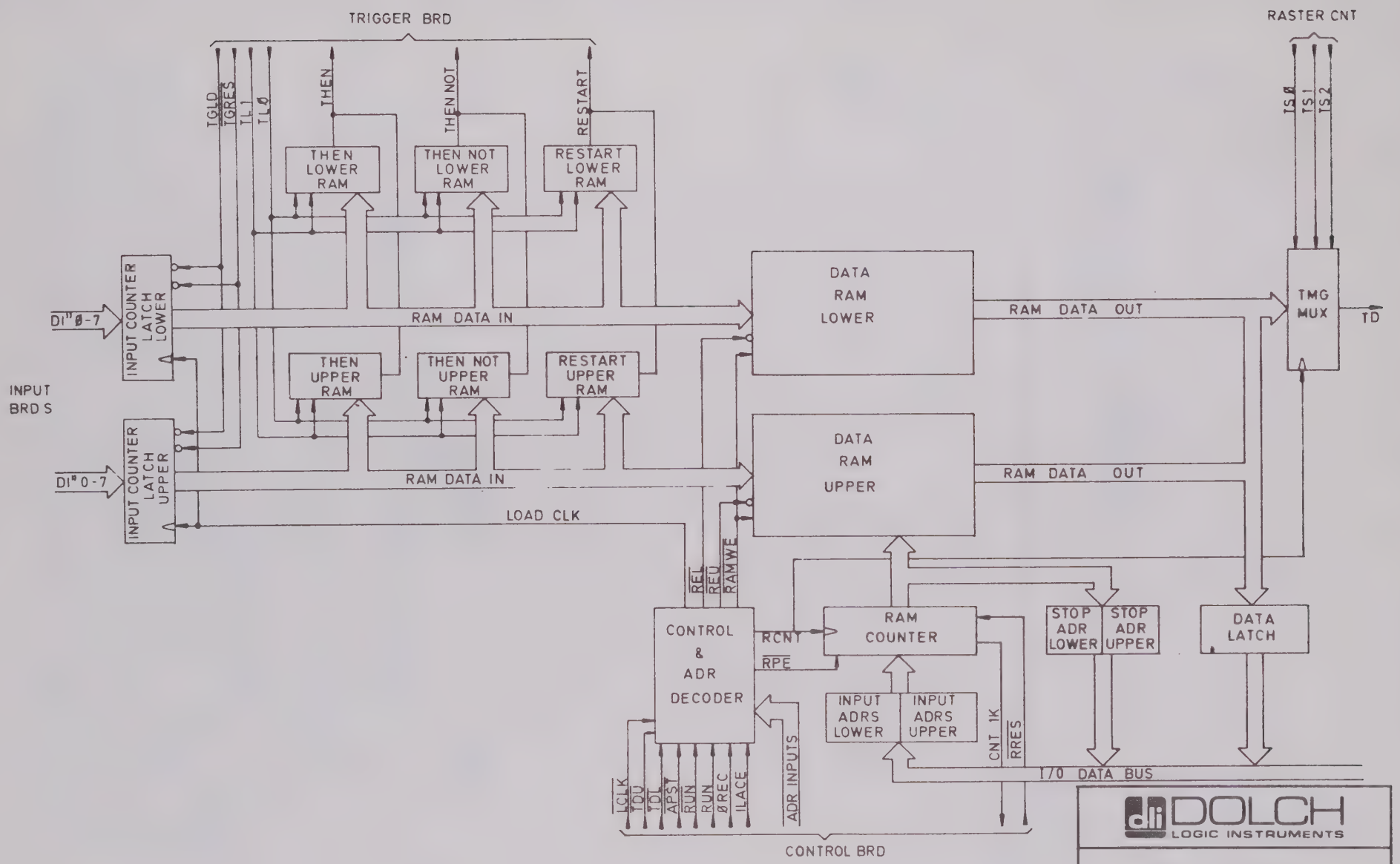
A		B
GND	1	GND
GND	2	GND
	3	
	4	
	5	
	6	
-5V	7	-5V
-5V	8	-5V
	9	
ADR 13	10	ADR 12
ADR 11	11	ADR 10
ADR 9	12	ADR 8
ADR 7	13	ADR 6
ADR 5	14	ADR 4
ADR 3	15	ADR 2
ADR 1	16	ADR Ø
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	
	26	
	27	
	28	
	29	
	30	
+5V	31	+5V
+5V	32	+5V

CODE	ERN	DATE	NAME
	REVISIONS	DATE	CHECK
			DRAWN

DOLCH LOGIC INSTRUMENTS

MEMORY BOARD 1

PART NUMBER	SHEET
5 3250 - 06	1/1



DOLCH LOGIC INSTRUMENTS

SBLA BOARD

PART NUMBER	SHEET
5 4850-06	1/1

J1

A	Pin	B
+ 5 V	1	+ 5 V
+ 5 V	2	+ 5 V
	3	DI 15
	4	DI 14
	5	DI 13
	6	DI 12
	7	GND
	8	GND
	9	DI 11
	10	DI 10
	11	DI 9
	12	DI 8
SBLA *	13	
- 12 V	14	- 12 V
- 12 V	15	- 12 V
+ 12 V	16	+ 12 V
+ 12 V	17	+ 12 V
C 7 = $\overline{MRKLD}$	18	C 6 = $\overline{CACKN}$
C 5 = $\overline{CRDY}$	19	C 4 = $\overline{CHAR\ RD}$
C 3 = $\overline{ACKN}$	20	C 2 = $\overline{I/O\text{-}WR}$
C 1 = DATA RDY	21	C Ø = $\overline{I/O\text{-}RD}$
A 1	22	A Ø
A 3	23	A 2
A 5	24	A 4
A 7	25	A 6
D 7	26	D 6
D 5	27	D 4
D 3	28	D 2
D 1	29	D Ø
	30	
GND	31	GND
GND	32	GND

*{ A 1 : BRDS 5
A 2 : BRDS 4
B : BRDS 1 }

J2

A	Pin	B
GND	1	GND
GND	2	GND
$\overline{APST}$	3	TD
	4	TS Ø
TS 1	5	TS 2
	6	$\overline{RRES}$
	7	$\overline{ØREC}$
	8	RUN
	9	LCLK
	10	$\overline{RUN}$
CNT 1K	11	$\overline{TDU}$
	12	$\overline{TDL}$
	13	GND
	14	TL Ø
ILACE	15	TL 1
	16	RESTART
	17	THEN NOT
	18	$\overline{THEN}$
	19	$\overline{TGLD}$
	20	$\overline{TGRES}$
	21	GND
	22	DI 7
	23	DI 6
	24	DI 5
	25	DI 4
	26	GND
	27	DI 3
	28	DI 2
	29	DI 1
	30	DI Ø
+ 5 V	31	+ 5 V
+ 5 V	32	+ 5 V

CODE	ERN	DATE	REVISIONS DATE	NAME

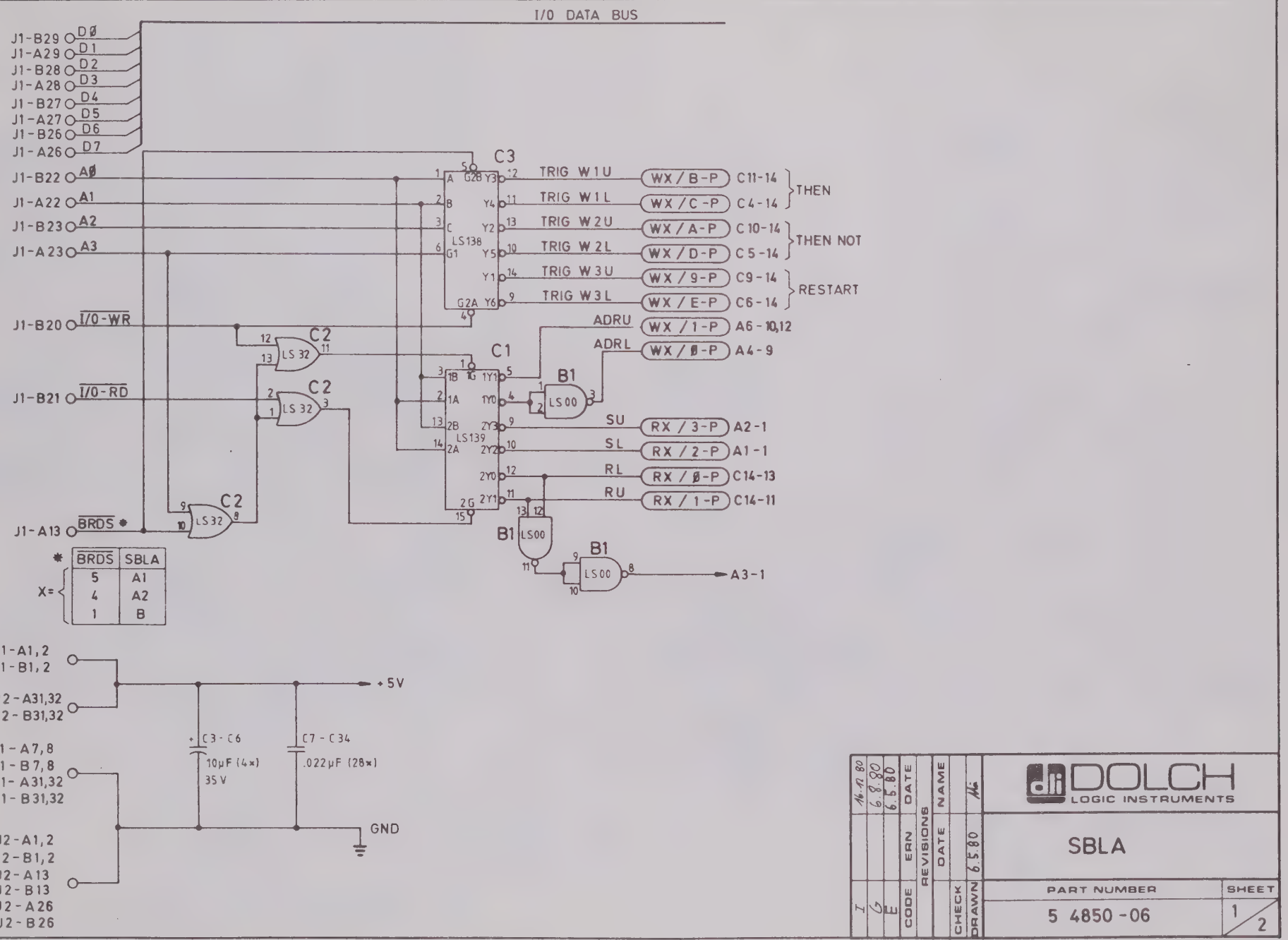
CHECK
DRAWN

DOLCH LOGIC INSTRUMENTS

SBLA BOARD

PART NUMBER: 5 4850 - 06

SHEET: 1/1



REVISIONS	DATE	NAME
ERN	6.5.80	
DATE	6.8.80	
	14.11.80	

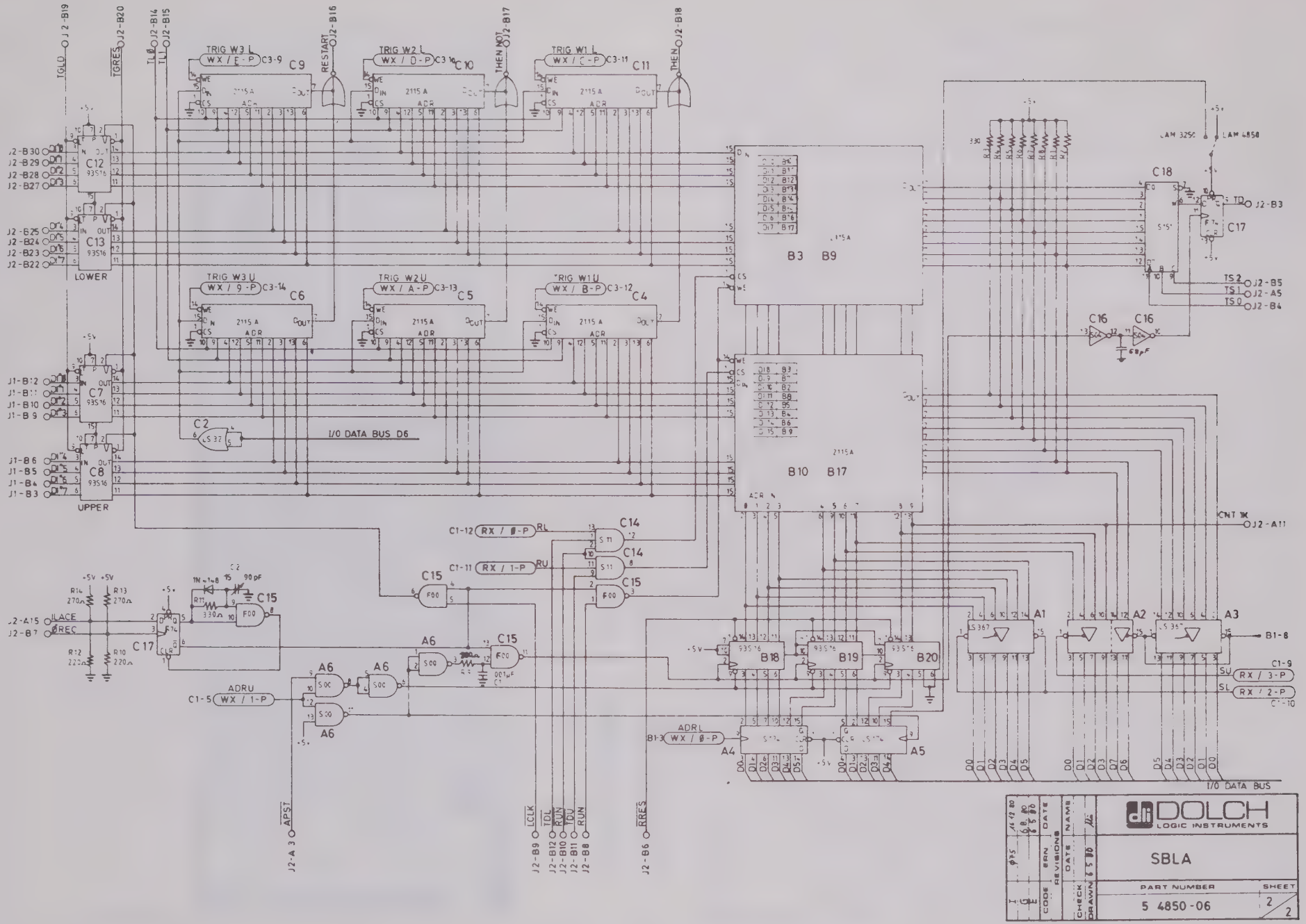
CODE	CHECK	DRAWN
I		
G		6.5.80
E		

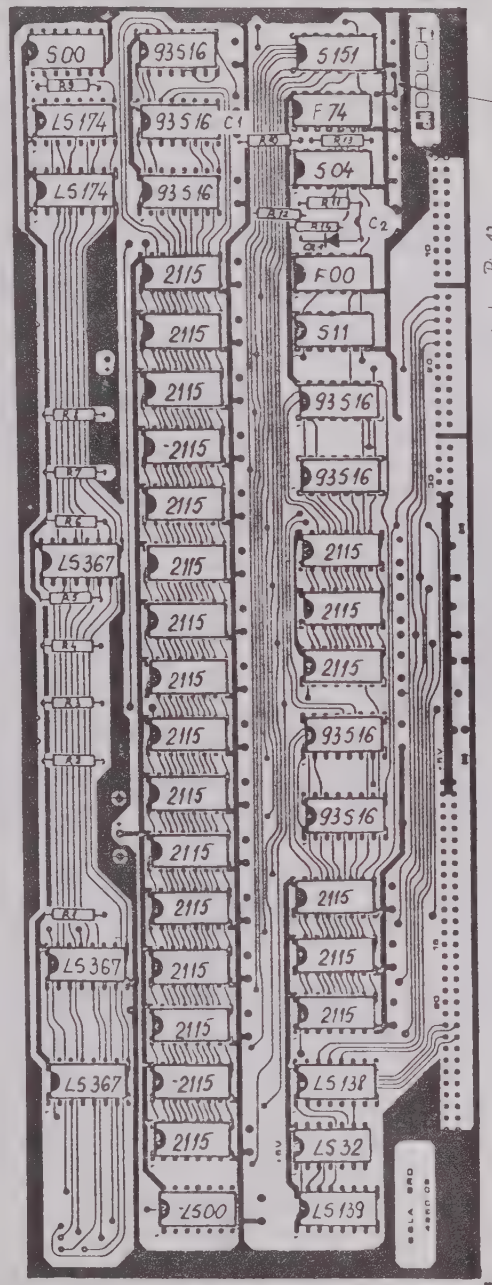
DOLCH LOGIC INSTRUMENTS

SBLA

PART NUMBER 5 4850-06

SHEET 1/2


TRIG W3 L
WX / E - P
C3-9
C9
TRIG W2 L
WX / D - P
C3-10
C10
TRIG W1 L
WX / C - P
C3-11
C11
RESTART
J2-B16
THEN NOT
J2-B17
THEN
J2-B18
TRIG W3 U
WX / 9 - P
C3-14
C6
TRIG W2U
WX / A - P
C3-13
C5
TRIG W1U
WX / B - P
C3-12
C4
2115 A
ADR
C12
C13
C7
C8
LOWER
UPPER
J2-B30
J2-B29
J2-B28
J2-B27
J2-B25
J2-B24
J2-B23
J2-B22
J1-B12
J1-B11
J1-B10
J1-B 9
J1-B 6
J1-B 5
J1-B 4
J1-B 3
C2
I/O DATA BUS D6
B3 B9
B10 B17
C18
C17
C16
68 pF
LAM 3250
LAM 4850
TD
J2-B3
TS 2
TS 1
TS 0
J2-B5
J2-A5
J2-B4
CNT 1K
J2-A11
C14
C15
C1-12
RX / 0 - P
RL
C1-11
RX / 1 - P
RU
B18
B19
B20
A1
A2
A3
LS 367
B1-8
C1-9
RX / 3 - P
SU
C1-10
RX / 2 - P
SL
A4
A5
ADRL
B1-3
WX / 0 - P
I/O DATA BUS
ILACE
ØREC
J2-A15
J2-B7
R14 270Ω
R13 270Ω
R12 220Ω
R10 220Ω
330Ω
90 pF
ADRU
C1-5
WX / 1 - P
A6
APST
J2-A 3
LCLK
TDL
RUN
TDU
RUN
J2-B9
J2-B12
J2-B10
J2-B11
J2-B8
RRES
J2-B6
DOLCH
LOGIC INSTRUMENTS
SBLA
PART NUMBER
5 4850-06
SHEET
2
2



POS.	ITEM	QTY	POS	ITEM	QTY
	LS00	1		10µF / 35V	4
	S 00	1		22n	28
	S 04	1	C3	68p	1
	S 11	1		14P Sockel	7
	LS 32	1		16P Sockel	37
	F 74	1			
	LS 138	1			
	LS 139	1			
	S 151	1			
	LS 174	2			
	LS 367	3			
	F00	1			
	93516	7			
	2115	22			
R11	330Ω	1			
R1-8	330 Ω	8			
R 9,12	220 Ω	2			
R13,14	270 Ω	2			
R9	100Ω	1			
CR1	1N 4148	1			
C1	1nF	1			
C2	5 - 90 pF	1			

GEPRUFT ... Okt. 1980

	Datum	Name
Bearb	24.3.81	Gehrke
Gepr		
Norm		

5 4850-6 A2 A1

Zust. Änderung Datum Name

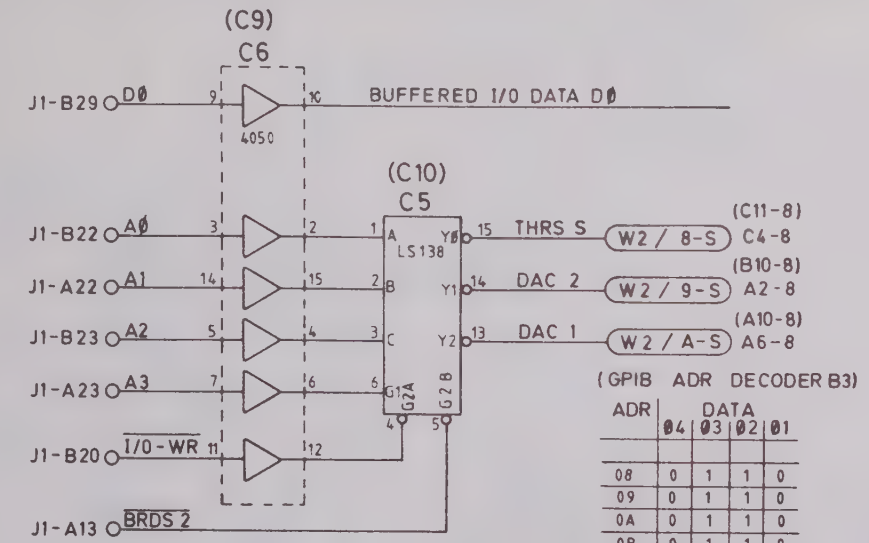
Maßstab | LAM 3250

ASS'Y DRAWING - PART LIST

DOLCH LOGIC INSTRUMENTS GMBH

SBLA BOARD I

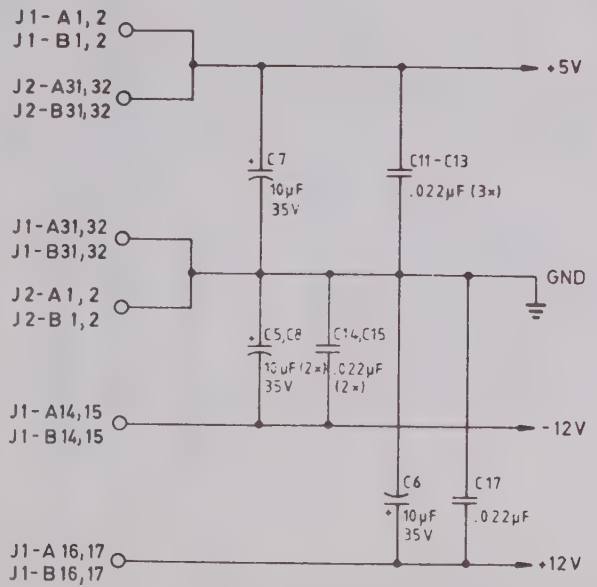
Blatt B



(- - -)=GPIB OPTION ONLY
5 4850-08

(GPIB ADR DECODER B3)

ADR	DATA Ø4	Ø3	Ø2	Ø1
08	0	1	1	0
09	0	1	1	0
0A	0	1	1	0
0B	0	1	1	0
0C	0	1	1	0
0D	0	1	1	0
0E	0	1	1	0
0F	0	1	1	0
28	0	1	0	1
ALL OTHER	1	1	1	1



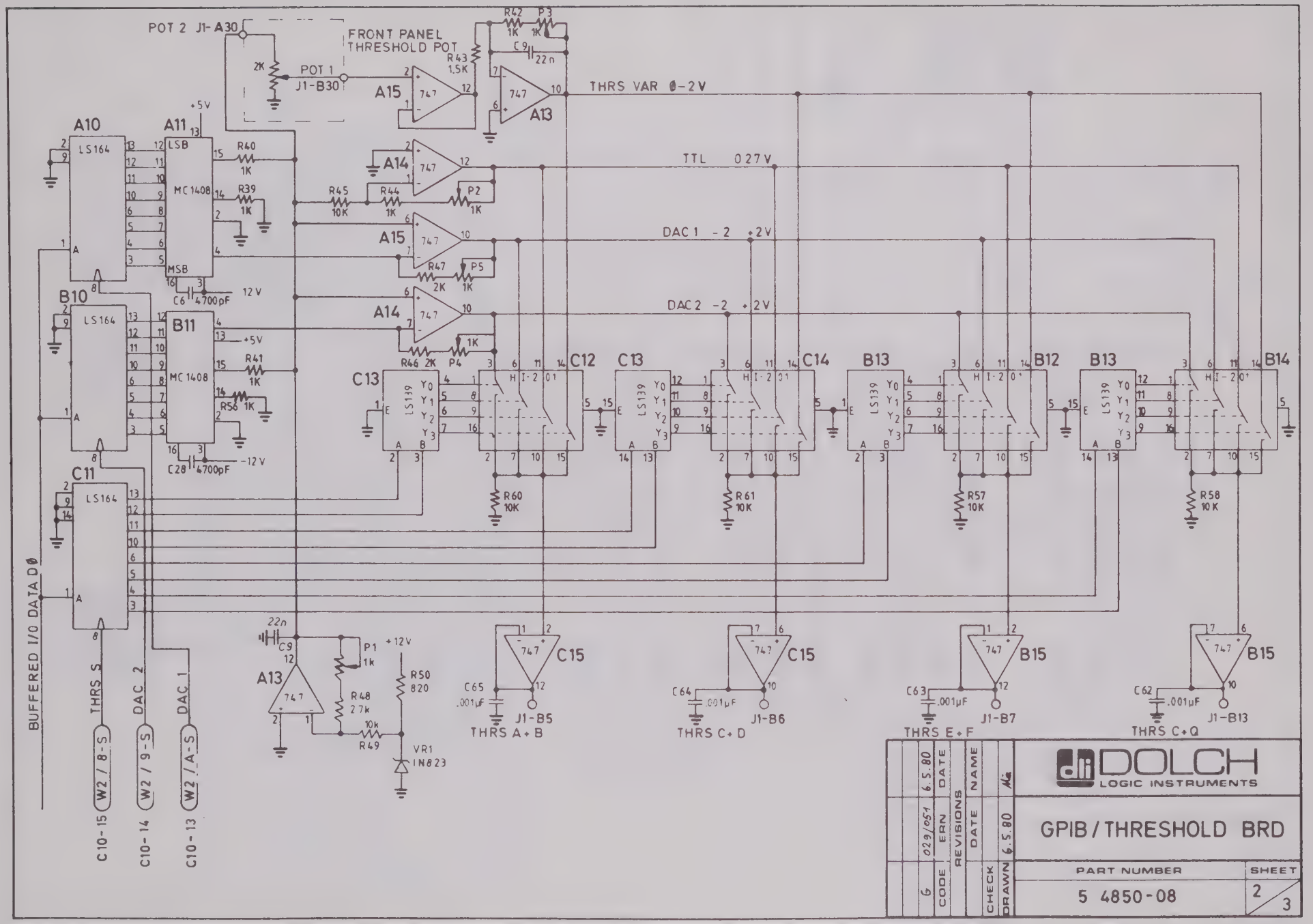
NOTES:
1. THRESHOLD BOARD WITHOUT GPIB LAYOUT: TO 5 4850-09

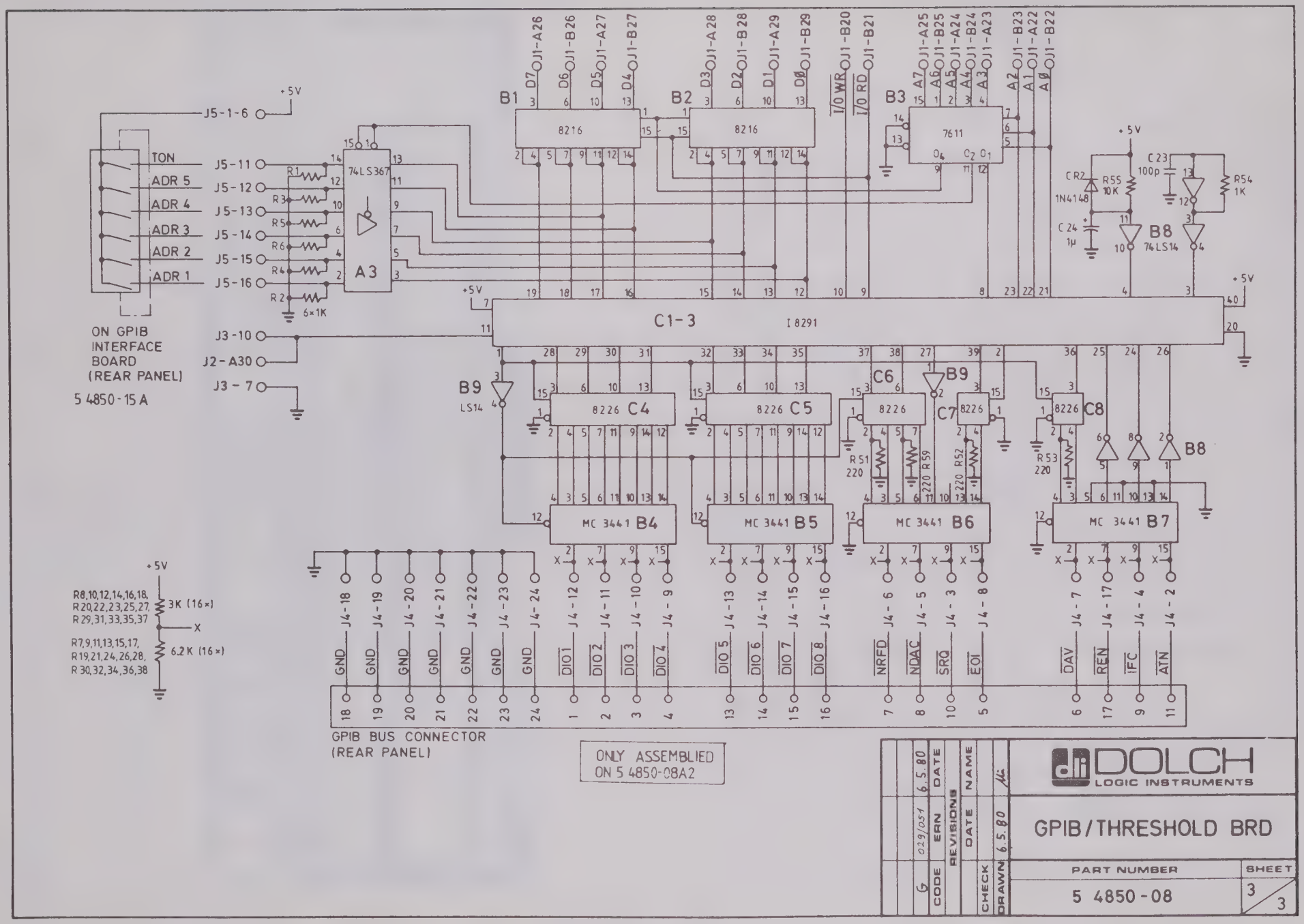
	6.5.80	DATE	NAME	
		ERN	REVISIONS	DATE
	G	CODE	CHECK	
			DRAWN	6.5.80

DOLCH LOGIC INSTRUMENTS

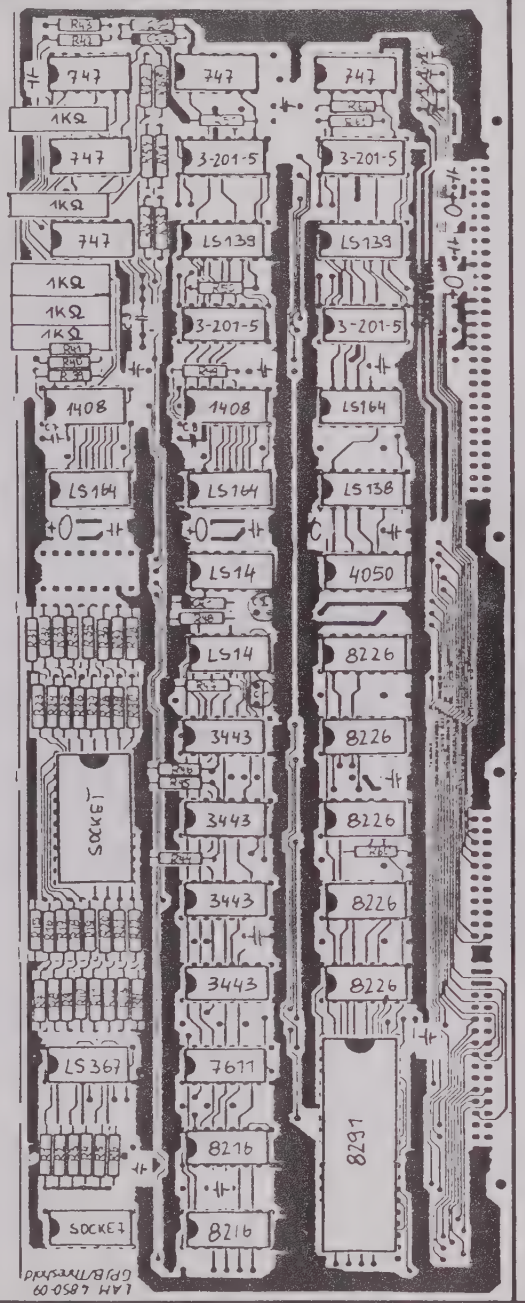
GPIB / THRESHOLD BRD

PART NUMBER	SHEET
5 4850-08	1/3


POT 2 J1-A30
FRONT PANEL THRESHOLD POT
POT 1 J1-B30
THRS VAR Ø-2V
TTL 0 27V
DAC 1 -2 +2V
DAC 2 -2 +2V
BUFFERED I/O DATA DØ
THRS S
DAC 2
DAC 1
C10-15 W2/8-S
C10-14 W2/9-S
C10-13 W2/A-S
THRS A+B
THRS C+D
THRS E+F
THRS C+Q
J1-B5
J1-B6
J1-B7
J1-B13
DOLCH LOGIC INSTRUMENTS
GPIB / THRESHOLD BRD
PART NUMBER
5 4850-08
SHEET 2/3
CODE G
ERN 029/051
DATE 6.5.80
REVISIONS
DATE
NAME
CHECK
DRAWN 6.5.80



ON GPIB INTERFACE BOARD (REAR PANEL)
5 4850-15 A
TON
ADR 5
ADR 4
ADR 3
ADR 2
ADR 1
J5-1-6
J5-11
J5-12
J5-13
J5-14
J5-15
J5-16
J3-10
J2-A30
J3-7
+5V
R1
R2
R3
R4
R5
R6
6×1K
74LS367
A3
B1
B2
B3
8216
7611
D7 J1-A26
D6 J1-B26
D5 J1-A27
D4 J1-B27
D3 J1-A28
D2 J1-B28
D1 J1-A29
DØ J1-B29
I/O WR J1-B20
I/O RD J1-B21
A7 J1-A25
A6 J1-B25
A5 J1-A24
A4 J1-B24
A3 J1-A23
A2 J1-B23
A1 J1-A22
AØ J1-B22
CR2
1N4148
R55 10K
C23 100p
R54 1K
C24 1µ
B8
74LS14
C1-3
I 8291
B9
LS14
8226 C4
8226 C5
8226 C6
8226 C7
8226 C8
R51 220
R59 220
R52 220
R53 220
MC 3441 B4
MC 3441 B5
MC 3441 B6
MC 3441 B7
R8,10,12,14,16,18, R20,22,23,25,27, R29,31,33,35,37
3K (16×)
R7,9,11,13,15,17, R19,21,24,26,28, R30,32,34,36,38
6.2K (16×)
GND
DIO 1
DIO 2
DIO 3
DIO 4
DIO 5
DIO 6
DIO 7
DIO 8
NRFD
NDAC
SRQ
EOI
DAV
REN
IFC
ATN
GPIB BUS CONNECTOR (REAR PANEL)
ONLY ASSEMBLIED ON 5 4850-08A2
DOLCH LOGIC INSTRUMENTS
GPIB/THRESHOLD BRD
PART NUMBER
5 4850-08
SHEET
3/3
CODE
G
029/051
ERN
DATE
6.5.80
REVISIONS
NAME
CHECK
DRAWN
6.5.80



POS.	ITEM	QTY	POS	ITEM	QTY
	747	5	R51, 48, 50, 56		7
	HI 3-2015	4	R43, 61, 62	10 K	
	LS139	2	R53	1K5	1
	LS164	3	R 57, 58	2K	2
	1408	2	R59	820 Ω	1
	LS138	1	R 44, 45, 46, 60	220 Ω	4
	4050	1	CR2	1N 823	1
	3443 / 3441	4	CR1	1N 4148	1
	8226	5	C9	22n	1
	8216	2	C1	100p	1
	7611 (PROM)	1	C2	1µF / 35V	1
	LS367	1	C3-6	1nF	4
	LS14	2		22nF	19
R7 -14				6,8µF / 35V	5
R 31 -38	6K2	16		R-Trimmer 1K	5
R15 -22				14P SOCKET	10
R 23 -30	3K01 1%	16		16P SOCKET	23
R39, 40, 41				40P SOCKET	1
R 47, 49	1K	13		16P Precision Socket	1
R 52, 54				24P Precision Socket	1
R 1-6				8291	1
R42	2K7	1	C7,8	4,7n	2

Maßstab | LAM 4850

ASS'Y DRAWING - PART LIST

	Datum	Name
Bearb	18.8.80	Gehrne
Gepr	19.9.80	Claus
Norm		

DOLCH LOGIC INSTRUMENTS GMBH

5 4850 08 A2

THRESHOLD / GPJB

Rev. G

Blatt

Bl

Zust | Änderung | Datum | Name

J 3

	8	9	
GND	7	10	GPIB INT
	6	11	
	5	12	
	4	13	
	3	14	
	2	15	
	1	16	

J 4

$\overline{\text{DIO 1}}$	12	13	$\overline{\text{DIO 5}}$
$\overline{\text{DIO 2}}$	11	14	$\overline{\text{DIO 6}}$
$\overline{\text{DIO 3}}$	10	15	$\overline{\text{DIO 7}}$
$\overline{\text{DIO 4}}$	9	16	$\overline{\text{DIO 8}}$
$\overline{\text{EOI}}$	8	17	$\overline{\text{REN}}$
$\overline{\text{DAV}}$	7	18	GND
$\overline{\text{NRFD}}$	6	19	GND
$\overline{\text{NDAC}}$	5	20	GND
$\overline{\text{IFC}}$	4	21	GND
$\overline{\text{SRQ}}$	3	22	GND
$\overline{\text{ATN}}$	2	23	GND
	1	24	GND

J 5

	8	9	
	7	10	
+5V	6	11	TON
+5V	5	12	ADR 5
+5V	4	13	ADR 4
+5V	3	14	ADR 3
+5V	2	15	ADR 2
+5V	1	16	ADR 1

CODE	ERN	DATE	NAME
	REVISIONS		
		DATE	
		CHECK	
		DRAWN	

DOLCH LOGIC INSTRUMENTS

GPIB/THRESHOLD BOARD

PART NUMBER	SHEET
5 4850 - 08	2/2

J1

A		B
+ 5 V	1	+ 5 V
+ 5 V	2	+ 5 V
	3	
	4	
	5	THRS A + B
	6	THRS C + D
	7	THRS E + F
	8	
	9	
	10	
	11	
	12	
$\overline{\text{BRDS 2}}$	13	THRS C + Q
- 12V	14	- 12 V
- 12V	15	- 12 V
+ 12V	16	+ 12 V
+ 12V	17	+ 12 V
C 7 = $\overline{\text{MRKLD}}$	18	C 6 = $\overline{\text{CACKN}}$
C 5 = $\overline{\text{CRDY}}$	19	C 4 = $\overline{\text{CHAR RD}}$
C 3 = $\overline{\text{ACKN}}$	20	C 2 = $\overline{\text{I/O-WR}}$
C 1 = DATA RDY	21	C 0 = $\overline{\text{I/O-RD}}$
A 1	22	A 0
A 3	23	A 2
A 5	24	A 4
A 7	25	A 6
D 7	26	D 6
D 5	27	D 4
D 3	28	D 2
D 1	29	D 0
POT 2	30	POT 1
GND	31	GND
GND	32	GND

J2

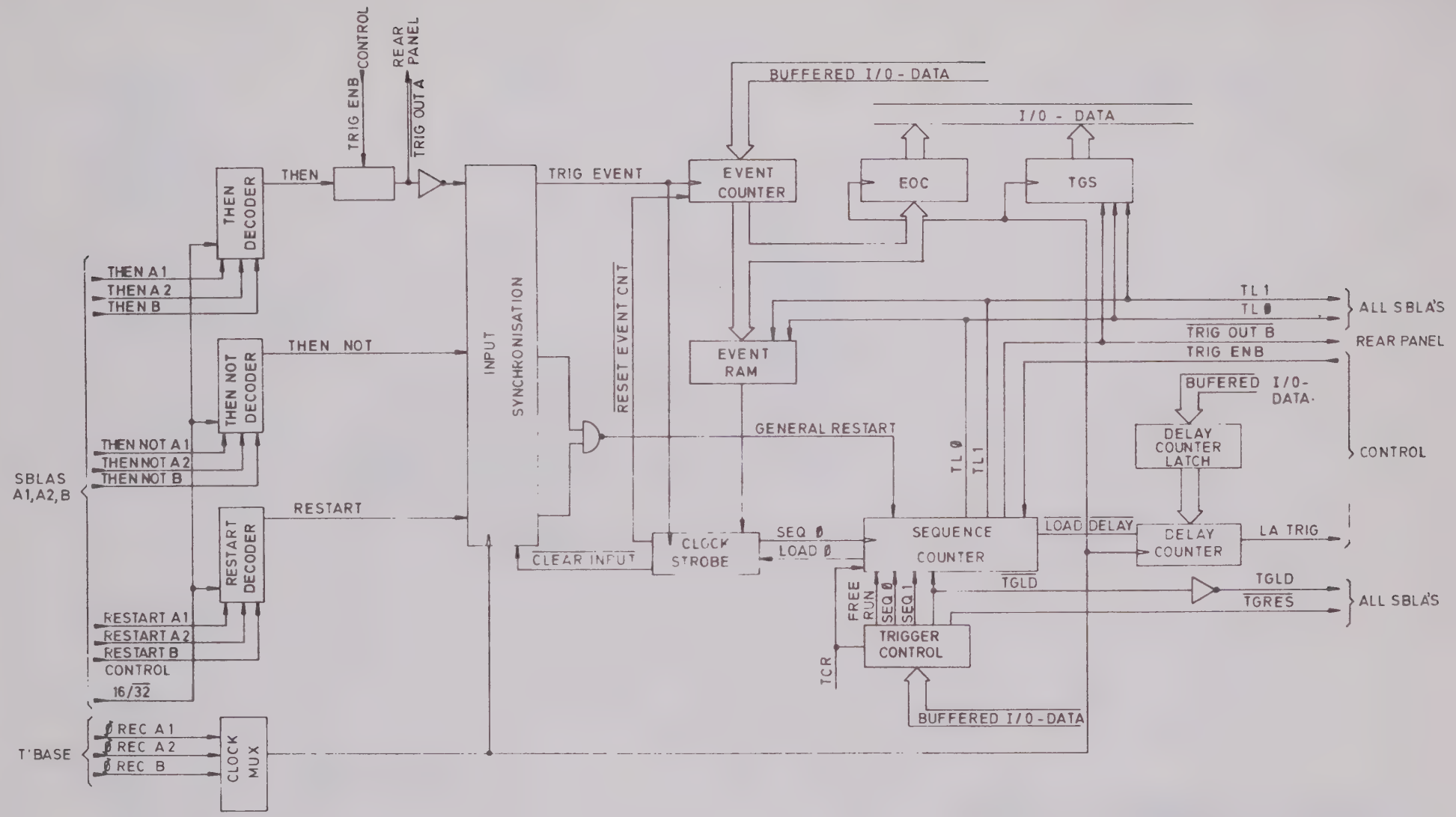
A		B
GND	1	GND
GND	2	GND
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14	
	15	
	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	
	26	
	27	
	28	
	29	
GPIB INT	30	
+ 5 V	31	+ 5 V
+ 5 V	32	+ 5 V

CODE	ERN	DATE	NAME
	REVISIONS	DATE	CHECK
			DRAWN

DOLCH LOGIC INSTRUMENTS

GPIB/THRESHOLD BOARD

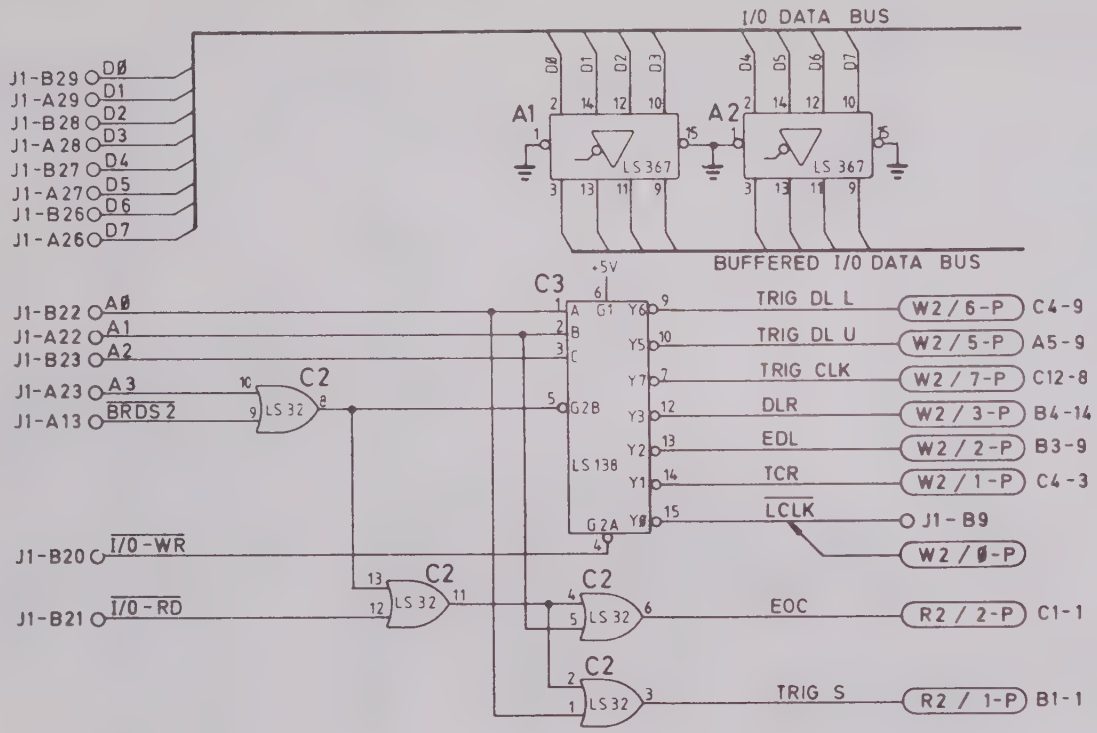
PART NUMBER	SHEET
5 4850 - 08	1/2

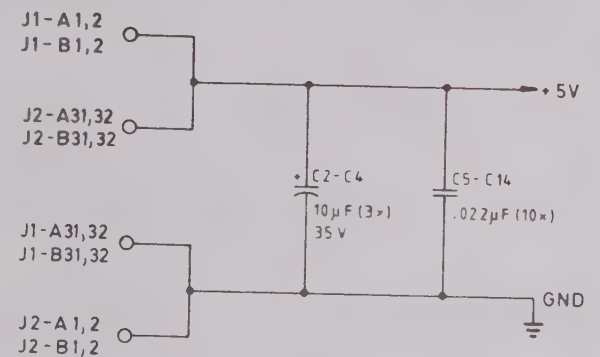


DOLCH LOGIC INSTRUMENTS

TRIGGER BOARD

PART NUMBER	SHEET
5 4850 - 10	1/1





NOTES:

1. SHEET 3 = REVISION G ONLY

REVISIONS	CODE	ERN	DATE	NAME
-			10.6.80	
I			6.5.80	
H				

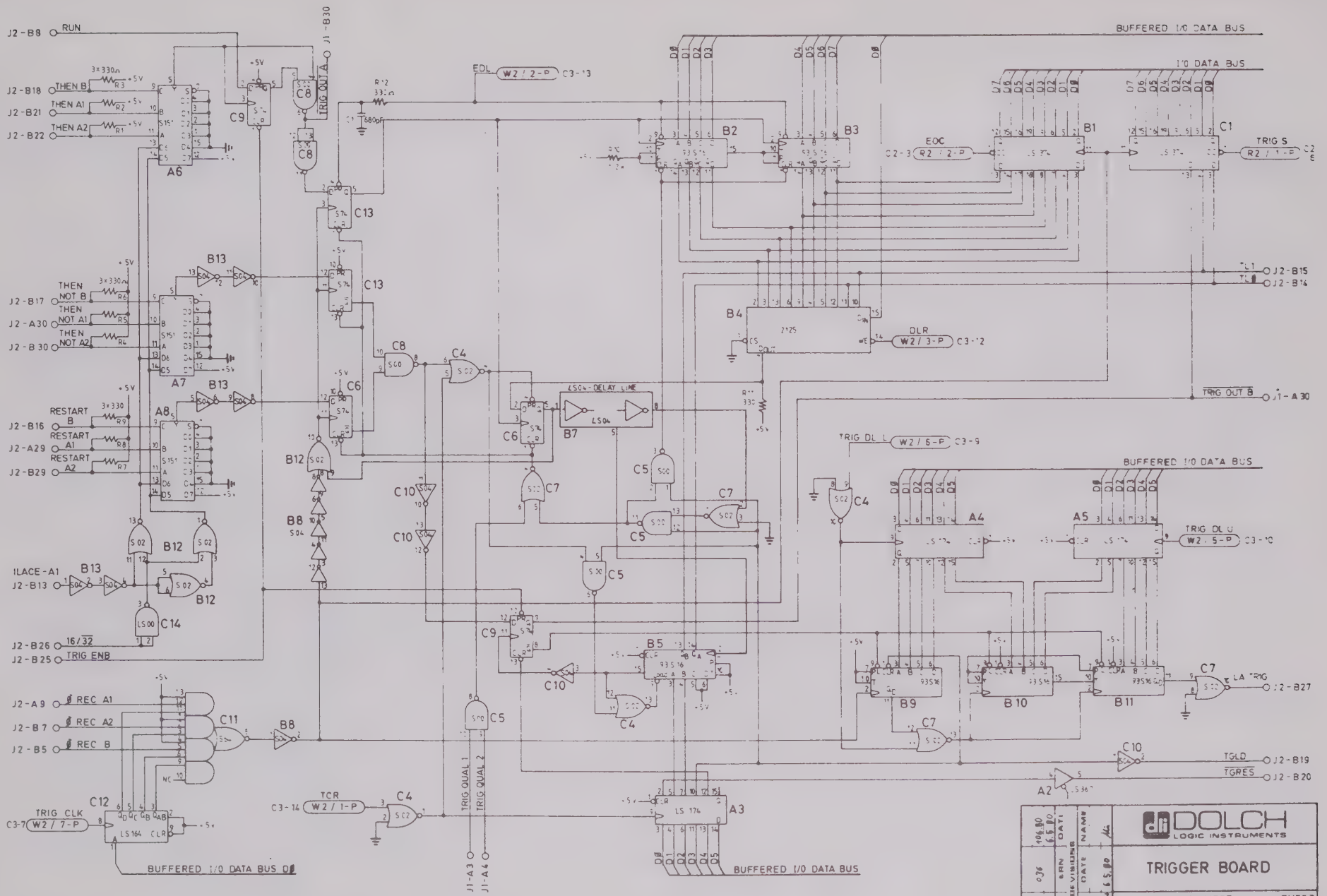
DRAWN 6.5.80 CHECK

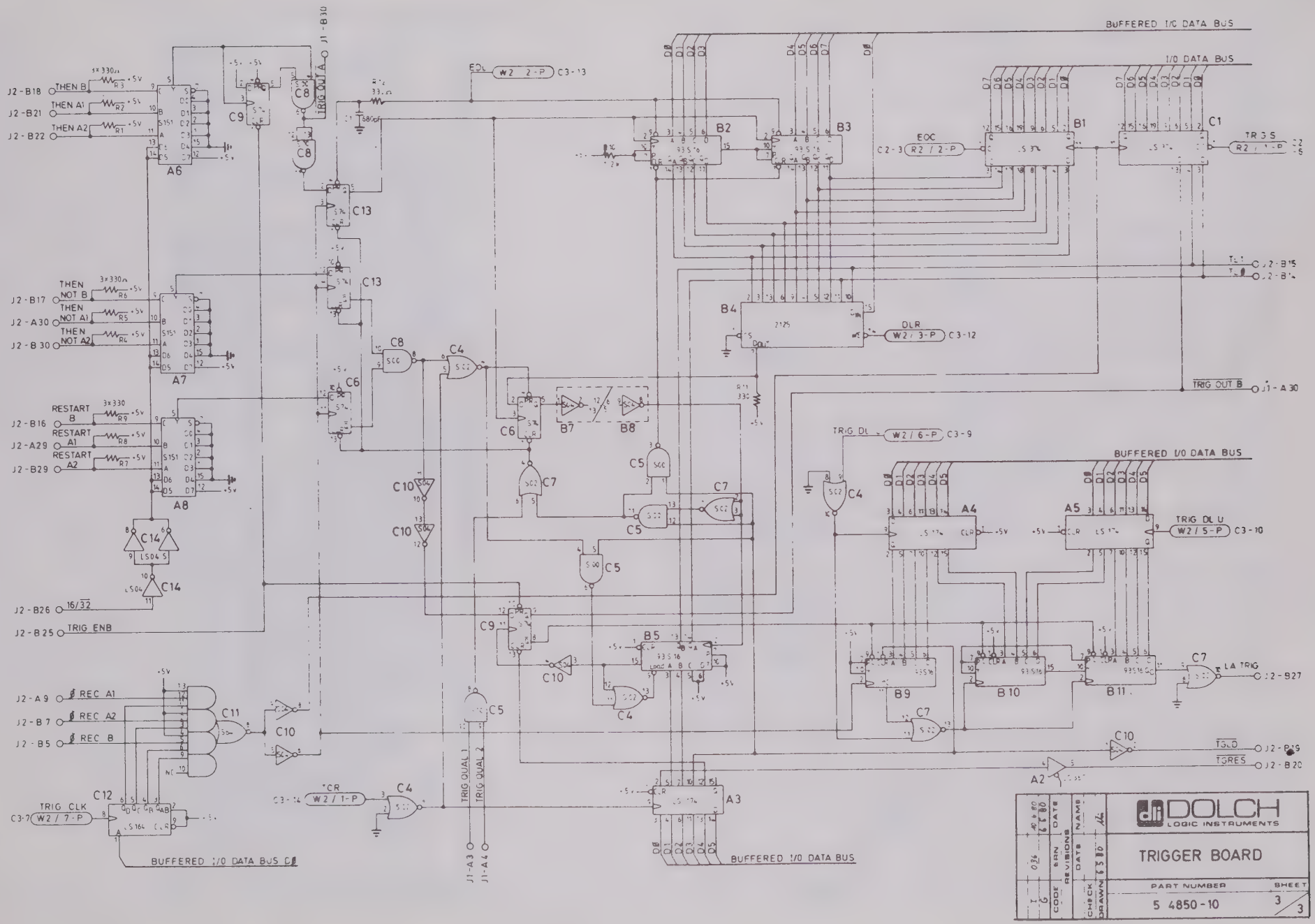
DOLCH LOGIC INSTRUMENTS

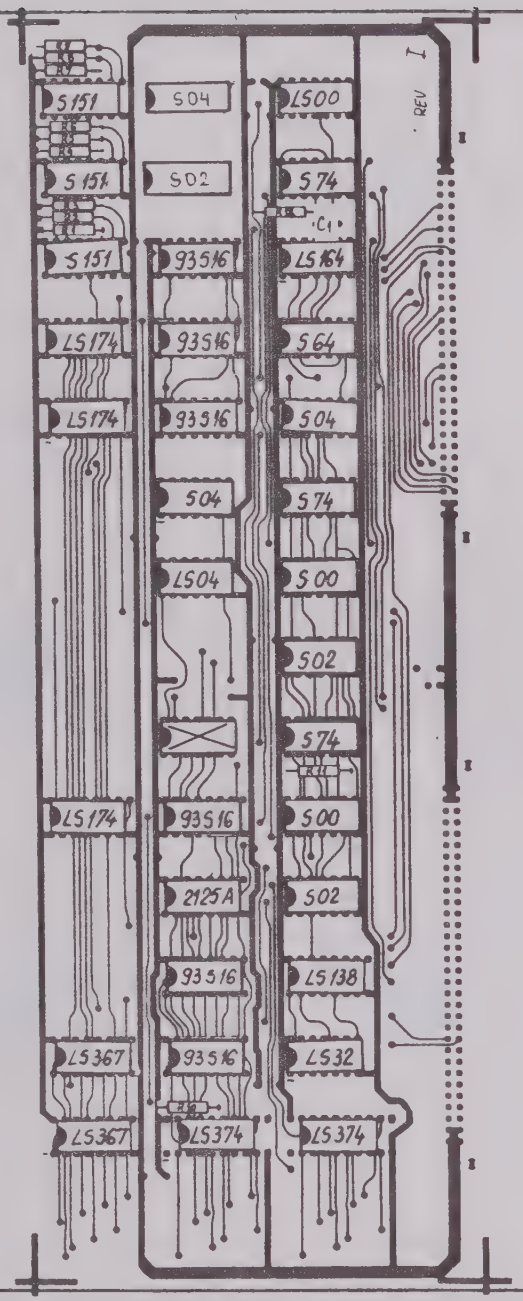
TRIGGER BOARD

PART NUMBER 5 4850-10

SHEET 1/3


J2-B8 RUN
THEN B
THEN A1
THEN A2
J2-B18
J2-B21
J2-B22
THEN NOT B
THEN NOT A1
THEN NOT A2
J2-B17
J2-A30
J2-B30
RESTART B
RESTART A1
RESTART A2
J2-B16
J2-A29
J2-B29
ILACE-A1
J2-B13
J2-B26 16/32
J2-B25 TRIG ENB
J2-A9 REC A1
J2-B7 REC A2
J2-B5 REC B
TRIG CLK
C3-7 W2/7-P
BUFFERED I/O DATA BUS D
TRIG OUT A
J1-B30
EDL W2/2-P C3-13
TCR C3-14 W2/1-P
TRIG QUAL 1
TRIG QUAL 2
J1-A3
J1-A4
LS04-DELAY LINE
BUFFERED I/O DATA BUS
EOC C2-3 R2/2-P
TRIG S R2/1-P C2
J2-B15
J2-B14
DLR W2/3-P C3-12
TRIG OUT B J1-A30
TRIG DL L W2/6-P C3-9
TRIG DL U W2/5-P C3-10
LA TRIG J2-B27
TGLD J2-B19
TGRES J2-B20
DOLCH LOGIC INSTRUMENTS
TRIGGER BOARD
PART NUMBER 5 4850-10
SHEET 2/3


BUFFERED I/O DATA BUS
I/O DATA BUS
J2-B18 THEN B
J2-B21 THEN A1
J2-B22 THEN A2
J2-B17 THEN NOT B
J2-A30 THEN NOT A1
J2-B30 THEN NOT A2
J2-B16 RESTART B
J2-A29 RESTART A1
J2-B29 RESTART A2
J2-B26 16/32
J2-B25 TRIG ENB
J1-B30 TRIG OUT A
EOL W2 2-P C3-13
EOC C2-3 R2 / 2-P
DLR W2 / 3-P C3-12
TRIG OUT B J1-A30
TRIG DL W2 / 6-P C3-9
TRIG DL U W2 / 5-P C3-10
LA TRIG J2-B27
TGLD J2-B19
TGRES J2-B20
J2-A9 REC A1
J2-B7 REC A2
J2-B5 REC B
TRIG CLK C3-7 W2 / 7-P
*CR C3-14 W2 / 1-P
TRIG QUAL 1
TRIG QUAL 2
J1-A3
J1-A4
BUFFERED I/O DATA BUS
DOLCH LOGIC INSTRUMENTS
TRIGGER BOARD
PART NUMBER 5 4850-10
SHEET 3/3



POS.	ITEM	QTY	POS	ITEM	QTY
	LS04	1	C_1	680p	1
	LS32	1		10µF / 35V	3
	LS 138	1		22 n	10
	LS 164	1			
	LS 174	3		14P Sockel	16
	LS 367	2		16P Sockel	16
	LS 374 (Texas Inst)	2		20P Sockel	2
	S00	2			
	S02	3			
	S04	3			
	S64	1			
	S74	3			
	S151	3			
	2125A / 2115	1			
	LS00	1			
	93S16 / S161	6			
R_{1-9}	330 Ω	9			
R_{10}	1K2	1			
$R_{11,12}$	330 Ω	2			

Maßstab LAM 4850

ASS'Y DRAWING - PART LIST

	Datum	Name
Bearb	23 7 80	Gehrke
Gepr	19 9 80	Claus
Norm		

DOLCH LOGIC INSTRUMENTS GMBH

5 4850-10

TRIGGER BRD I

Blatt

Zust | Änderung | Datum | Name

J1

A		B
+5 V	1	+5 V
+5 V	2	+5 V
	3	TRIG QUAL 1
	4	TRIG QUAL 2
	5	CLOCK ON/OFF
	6	
	7	
	8	
	9	
	10	
	11	
	12	
BRDS 2	13	
-12 V	14	-12 V
-12 V	15	-12 V
+12 V	16	+12 V
+12 V	17	+12 V
C7 = MRKLD	18	C6 = CACKN
C5 = CRDY	19	C4 = CHAR RD
C3 = ACKN	20	C2 = I/O - WR
C1 = DATA RDY	21	C0 = I/O - RD
A1	22	A0
A3	23	A2
A5	24	A4
A7	25	A6
D7	26	D6
D5	27	D4
D3	28	D2
D1	29	D0
TRIG OUT B	30	TRIG OUT A
GND	31	GND
GND	32	GND

J2

A		B
GND	1	GND
GND	2	GND
	3	
	4	
	5	REC B
	6	
	7	REC A 2
	8	RUN
REC A 1	9	LCLK
	10	RUN
	11	
	12	
	13	
	14	TL 0
	15	TL 1
	16	RESTART B
	17	THEN NOT B
	18	THEN B
	19	TGLD
	20	TGRES
	21	THEN A 1
	22	THEN A 2
	23	
	24	
	25	TRIG ENB 1
	26	16/32
	27	LA TRIG
	28	
RESTART A 1	29	RESTART A2
THEN NOT A 1	30	THEN NOT A2
+5 V	31	+5 V
+5 V	32	+5 V

CODE	ERN	REVISIONS	DATE	NAME
			DATE	CHECK
				DRAWN

DOLCH LOGIC INSTRUMENTS

TRIGGER BOARD

PART NUMBER	SHEET
5 4850 - 10	1/1

DOLCH
LOGIC INSTRUMENTS

GmbH · Justus-v.-Liebig-Str. 19 · D-6057 Dietzenbach/West Germany · Tel. (0 60 74) 20 66 · Telex 4 191 550 dli d
Inc. · 230 Devcon Drive · San Jose CA 95112/USA · Tel. (408) 9 98 57 30, (800) 5 38-75 06 · Telex (910) 338-2023 dolch snj